A STUDY OF INFLUENTIAL SOCIO-ECONOMIC FACTORS AFFECTING FERTILITY IN BAHIR DAR TOWN (1994/95)

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ABSTRACT

Ethiopia is one of the developing countries that experiences a rapid population increase. Based on the 1984 census data the growth rate of the population of Ethiopia was estimated to be 2.9 percent. A population growth rate above 2 percent would pose a problem for the country's development. Therefore, it is of prime importance to study the factors which influence fertility so as to achieve a reduction in growth rate of population.

In this paper an attempt has been made to assess the influence of some socio-economic factors on fertility taking a typical growing town, Bahir Dar. The method of regression was used to examine the influence of some selected factors on fertility. Among the factors considered in the study women's employment was inversely related to fertility, though this relationship was found to be not significant in the younger and older age groups. The educational level of wife and husband also appeared to have an inverse relationship with fertility only in certain age groups. It seemed that income had a positive effect on fertility. There was no significant difference in fertility between muslims and christians, and between the Amharas and other ethnic groups taken together.

The demographic feature for Bahir Dar, hopefully, can be representative of other towns in the country, and hence may be used to indicate what types of measures have to be taken in order to challenge the problem of population growth, especially in townships.

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CHAPTER 1: INTRODUCTION

1.1 GENERAL BACKGROUND

In the long run of history, the second half of the twentieth century stands out for its remarkable population growth. Before the eighteenth century, though the general trend was a rising one population growth was not steady; the balance of birth over death was tenuous, and crises such as war and plague periodically reduced population in parts of the world. Only in the eighteenth century did the number of people started to rise steadily. From 1750 until well into the twentieth century, the world's population grew at the then unprecedented rate of about 0.5 per year, faster in today's developed countries, slower elsewhere. World population size doubled again, this time in about 150 years; it had reached about 1.7 billion by 1900. In the twentieth century, growth continued to accelerate from an annual rate of 0.5 to 1 percent until about 1950 and then to a remarkable 2 percent. In just over 30 years, between 1950 and today, world population nearly doubled again growing from 2.5 billion to almost about 4.8 billion.

Since 1950 population growth has become a serious problem in developing countries of which Ethiopia is one. The post war experience of developing countries was not only different but historically unprecedented. Driven by falling mortality and continued high fertility, their population growth rate rose to about 2 percent a year. It peaked at 2.4 percent in the 1900's. It is now about two percent a year because of a slightly greater decline in birth rates than in death rate.

In Ethiopia, as in most developing countries, while mortality has been declining in the past 30 years with the crude death rate falling from 32 to 23.6 per thousand, fertility has remained persistently high with the crude birth rate at 52.3 per thousand during 1950-55 and 47.3 during 1985-90 (UN, 1989). The population of Ethiopia has increased steadily and population growth rate of the country has also been accelerating as a result of this high fertility rate and gently declining death rate.

The population of Ethiopia was estimated about 51 million in 1991. If the current fertility schedule were to remain unchanged, then according to a projection of the Central Statistical Authority (CSA) from 1988 the total population would be expected to increase about fivefold by the year 2035. Even under the assumption of a 60 percent decline in total fertility rate over the same period the total population is expected to increase to 165 million by the end of the projection year.

The main population problem having a negative impact on the country's socio-economic development effort is the high fertility rate which largely accounts for the rapid rate at which the population is growing. High population growth rate is generally considered to be a deterrent to rapid economic development. Hence the study of the factors related to high fertility levels, and those associated with fertility decline, assumes great importance in view of the high rate of population growth currently experienced by Ethiopia. This study focuses on socio-economic factors (education, employment, religion and ethnicity) which influence fertility of female population of Bahirdar town.

1.2 STATEMENT OF THE PROBLEM

Rapid population growth at rates above 2 percent common in most developing countries today acts as a brake to development. Up to a point, population growth can be accommodated: in the past three decades many countries have managed to raise average income even as their population grew rapidly. In that strict sense, population growth has been accommodated. But the goal of development extends beyond accommodation of an ever larger population; it is to improve people's lives. Rapid population growth in developing countries has resulted in less progress than might have been - lost opportunities for raising living standards, particularly among the larger number of the world's poor.

In poor countries high rates of population growth tend to exasperate problems of development and it has become a vicious circle that with high rate of population growth dependency increases, and under high dependency rates, propensity to save is reduced, Hence investment prospect become bleak,and with reduced investment aggregate productivity decline, and hence the ratio of capital to labour is distorted and manifested in high rates of unemployment,low wage and with that prospensity to save declines further. Rapid rate of population growth also tends to promote high rate of urbanization which in turn increases the problem of unemployment in urban areas.

The rapid population growth in Ethiopia in recent years poses serious difficulties in the efforts to achieve economic and social development. It is this awareness of the adverse effect of rapid population growth that initiated us to study the socioeconomic factor which influence fertility.

1.3 OBJECTIVE OF THE STUDY

It is unquestionable that fertility is the critical component of rapid population growth. Today Ethiopia is experiencing one of the most rapid increases in population. Based on the 1984 census data the growth rate of the population of Ethiopia was estimated to be 2.9. Because this rate is large indicating rapid population growth which is a hinderance to socio-economic development, effective fertility-reducing program based on research on the factors which influence fertility should be designed. Once these factors which favor an increase in natural fertility are identified measures should be implemented to counteract their effect. If measures are to be implemented successfully a reduction in fertility may be achieved. Therefore, the main objectives of this study are:

1. To assess the influence of some selected socio-economic factors which are commonly cited as bearing a causal relationship to fertility and determine the relative significance of each of the factors when all others are held constant.
2. To recommend certain policy implications of the findings which could accelerate fertility decline if implemented successfully.

1.4 REVIEW OF RELATED RESEARCH

Over the years demographic research has revealed that fertility is the critical component of rapid growth of the total population. Therefore, it is of prime importance to design effective fertility-reducing programs based on research on the socio-economic factors influencing fertility.

This paper investigates the structure of the relationship between fertility and socio-economic variables (education, employment, religion and ethnicity). In this section an attempt has been made to present review of some related research.

FEMALE EDUCATION AND FERTILITY

Education has consistently shown to be inversely related to fertility and it is often said that high level of education leads to greater use of contraception and consequently, to lower fertility. It may also help in attaining desired family size thereby raising desired living standards and provides a great range of general information, better understanding of reproductive purpose and access to modern and effective means of birth control. Thus education is likely to be inversely associated with fertility (Chaudhury, 1978). Researchers have successively attempted to find out the relationship between the two and below are cited some of the findings by different researchers.

The results of a study on the socio-economic factors (employment, social composition, wealth and literacy) influencing fertility by Craft (1911) suggest that illiteracy tends to raise fertility although its effect was weak.

Another study made by Jain (1981) suggests that in general, raising female education at the individual level leads to a decrease in marital fertility but its magnitude varies from country to country. The study concluded that in some cases, the association between the two is curvilinear, that is, a small decrease in female education is associated with an increase in their marital fertility.

Based on studies on ten selected developing countries[1] the evidence obtained indicated that total fertility rate is inversely related to women education in all of the countries except in two, namely Indonesia and Srilanka. In fact, in Srilanka, the fertility of women with no schooling was almost equal to that of women with seven or more years of education and there was no significant difference in fertility levels between the different levels of education considered. In Indonesia, however, the fertility of educated women was considerably higher than that of women with no education. The inverse relationship between education and fertility is often violated by the groups with one to three years and four to six years of education especially where these groups contain few respondents.

The above finding reveals that the form and size of the relationship between education and fertility vary considerably from country to country. This finding seems to agree with that of Hocraft and Casterline (1983). They concluded that whilst a monotonic negative effect of increasing level of education was evident from the majority of the countries under study, the relation was curvilinear in Jamaica (and possibly) in Kenya and positive in Bangladesh and Indonesia. In the latter two countries, increasing level of education is associated with rapid childbearing; as these are also countries for which education is simply an additive main effect; that is to say, for any set of combination of other variables, the effect of education will be to increase childbearing by some fixed amount, without depending on any other variables.

Another investigation on fertility-education relationship showed that total fertility rates are inversely related to level of education but this rule is violated often by the 1-3 years and 4-6 years subgroups especially where this contain few respondents[2].

According to a study by Yang (1982) on the relationship between education and fertility the age-specific and total fertility rate by education showed substantial differences by educational categories. The results indicate that women with no schooling have a total fertility rate which is twice as high as women with some schooling.

Craft and Litle (1984), in their work on the Dominican Republic, have come to a conclusion that education is one of the socio-economic factors which determine a set of cultural attitudes which in their turn determine behaviour relating to reduction in exposure to fertility.

In studying the influence of education and other socio-economic factors on number of children ever born, Ketar (1979) inferred that Women's education is inversely related to their fertility rate.

The relationship between education and fertility seems to be similar in countries of Sub-Saharan Africa and Women with a few years of schooling usually have the highest fertility. By contrast, fertility differential in most countries of North Africa, Latin America and the Caribbean, and West Asia are large and fertility decreases consistently with increasing education. In roughly 40 percent of the countries (in Africa, Latin America and the Caribbean, Asia and Oceania) with available information, women with seven or more years schooling will have under half as many children as women with no education at current rates of childbearing[3].

Based on data from Ghana, investigation on fertility-education relationship, resulted in a steady decline in fertility with increased level of education attainment. It was, however, apparent that the influence of women's education on fertility was significant only after post-primary levels; the effect of education becomes undoubtedly more significant among women with carrier building educational background. The latter group tends to marry at late ages than other groups. The evidence here supports the view that education influences fertility, but only through its interaction with intermediate variables such as exposure to risk of conception, family planning and age at marriage[4].

Evidence from fertility differentials by women's education in Nigeria has been demonstrated by results from a number of demographic surveys carried out in 1970. Data on mean number of live birth by women's education for Lagos showed lower number of births for women with no education in all ages 20 years and above. This consistent difference is probably due to differential reporting of births. The lower means for women who have had no education result in part from greater memory lapse among these women than among women with elementary or secondary education. Women with secondary school education have on the average fewer births than women with elementary education.

Data from the 1972 census of Mauritania also present convincing evidence of negative correlation between fertility and women's education. For all ages, average family size (total number of birth per woman) is markedly low for women with secondary or higher education, and in all age groups higher for women with no education[5].

In studying the effect of education on fertility for female population of Higher 6, Kebele 25 (Addis Ababa, Ethiopia), Ghebre (1989), found that there was little fertility difference between the illiterates and those with formal education. In his analysis of the specific mechanisms through which education affects fertility, controlling for age at first marriage, he found that, regardless of the level of educational attainment, fertility was lower among those who married later than earlier and was more so among the illiterates than those with formal level of education.

FEMALE EMPLOYMENT AND FERTILITY

Greater female participation in the labour force has often been suggested as a means of reducing fertility. This suggestion is based on the assumption that employment outside home provides alternative satisfaction for a woman which may comp ete with her raising children . If work outside home comp etes with childbearing, occupationally working woman would be expected to practice contraception more frequently and to have fewer children than non-working woman.

The current theory regarding female labour force participation and fertility postulates that female labour force participation will not result in low fertility per se unless there is greater incompatibility between the roles of mother and workers. In rural areas women are mainly engaged in farm-work which doesn't necessarily take away a married woman far from home. Conversely, work in modernized sector of the economy in the urban areas means separation of work from home and substitute parents are rare. Role conflict is thus more likely among women working in urban areas.

The relationship between women's employment and fertility is of great policy interest. There has been numerous studies on the topic, which suggest that the relationship between work and fertility is not a simple inverse one but rather it is ambiguous.

The simple relationship between fertility and employment status in work since marriage (worked, not worked) is examined in this study. Rodrigues and Cleavland (1981) conducted a large scale comparative study on this relationship and found a strong relationship between work status (no work, family or self employed and other non family employee) and fertility, with non family workers having the lowest fertility, as expected (given that they are most likely to work away from home and to be paid in cash), and those who had not worked since marriage showing the highest fertility. Among the selected developing countries included in the study only in Bangladesh, Fiji, Indonesia and the philippines did women employed by others have the highest, with those who worked for family or were self employed in between. In Korea, Srilanka and Thailand full inverse relationship was not found.

In the majority of the countries (7 out of 10) women employed by others had the lowest fertility and the difference between the categories "no work" and "work for the others" were of considerable magnitude.

In studying the employment-fertility relationship Chaudlury (1978) found that fertility of working women was significantly different from those women who have not worked irrespective of their length of employment.

Using retrospective data from the 1984 family history survey of statistics Canada, Ram and Rahim (1983) found support for the view that women's early employment experience increases the length of birth interval.

In another study[6] fertility was also found to be strongly associated with employment profile of respondents. The interview conducted during this study showed that women who were occupationally working have fewer children than those who were not engaged in such work. This phenomenon tends to increase gradually depending on respondents degree of involvement. Fertility appears also to be affected by place and nature of work. Women working at home have distinctly higher fertility than those working outside their homes, and those working part-time have more children than those working fulltime.

In studying the employment-fertility relationship for female population of Higher 6, Kebele 25 (Addis Ababa, Ethiopia), Ghebre's finding indicates that fertility difference between working and non-working categories of women was not substantial. Regarding the specific mechanism through which female labour force participation influences fertility the study showed that when age at first marriage - was controlled (held) constant, fertility was found to be lower among those who married later than earlier and not-working groups of the study population were found to marry earlier than those working.

More recently, differences in fertility among various ethnic groups living in similar economic and environmental condition have been identified in several African countries. Few examples of these differential are discussed here to highlight the magnitude of the problem rather than provide a comprehensive review of the ethnic differences in fertility in different regions of Africa.

Henin (1969), who compared the fertility of nomads and settled "rain cultivators" in the Sudan, concluded that the incidence of childlessness was higher amongst the nomads than the rain cultivators.

Brass (1968) analyzed data from northern Cameroon which showed higher proportion of childless women in different age groups for moslem than non-moslem tribes.[9]

A number of studies in the United Republic of Cameroon in the 1960's showed that, while fertility was higher among the Bamilike, Kirdi and the Bassa, recorded fertility rates for Dakweri in the extreme south-west, the Fang-Beti in eastern province were much lower than the national average.

Another study by Arya (1979) in Uganda showed a significant difference between the fertility of Eteso and Banyankole living in the Sorotic and Mbarara district, respectively.

Anne (1974) presented evidence to show that fertility of Bodoulė in Upper Volta in markedly lower than that of their neighbours, the Mossi.

Ghebre, who studied the relation between the socio-economic variables (female education, female labour force participation and ethnicity) in Higher 6, Kebele 25 (Addis Ababa, Ethiopia), found that fertility was lowest among the Amharas, highest among the Oromos but not substantially higher than that of the Gurages. Regarding the relationship between ethnicity, the proximate determinants and fertility, his finding showed that when age at first marriage was held constant, fertility was lower among those who married later than earlier and female population of the Gurage followed by female population of Oromo and Amhara were found to marry earlier than the female population of any other ethnic group.

RELIGION AND FERTILITY

Empirical research show that religious affiliation has a significant influence on fertility. For example, Catholics usually exhibited higher fertility than Jews or Protestants, with Jews showing the lowest fertility of the three groups. The majority of the studies also indicate that Muslims show a higher fertility level than Non-Muslims[7].

Multiple regression analyses of data on college-educated wives from the 1976 National Survey of Family Growth[8] showed that religion was significantly related to fertility; fertility being higher among Catholics than Protestants. The above observation, that means higher Catholic cumulative fertility among Catholic College-educated women can be attributed to the fact that Catholics attend sectarian schools and colleges that discourage birth control education.

[1]Fertility behavior context of development: Evidence from the world-survey (1987).

[2]Comparative Study: Socio-economic differential in recent fertility, No. 33 (1984).

[3]Fertility behavior context of development: Evidence from the world survey (1987).

[4]UNECA Fertility, Education and Population Growth in Africa: ECA - PPL Working Paper No. 1976/2, 1976, p.6.

[5]Population Dynamics: Fertility and mortality in Africa, 1979.

[6] Comparative Study: Family size preference, No. 26, October 1983.

[7] Chamie, J.: Religious Differential in Fertility: Lebanon (1971); Population Studies Vol. 32, No. 2, July 1977, pp. 365-382.

[8] Nane, J.: Religious Differential in Reproduction: The effect of sectarian education, Demography Vol. 19, No. 4, November 1982.

[9] Ardener E., Divorce and Fertility, Nigerian Institute of Social and Economic Research (NISER) OUP, 1962.

CHAPTER 2: DATA, DEFINITION AND METHODOLOGY

2.1 DATA COLLECTION, SOURCE AND LIMITATIONS

Data used in this study were collected in the course of a demographic socio-economic and housing characteristics survey in Bahirdar. The survey was conducted by the National Urban Planning Institute (NUPI) in July and August, 1994.

The sampling method applied in the survey was stratified systematic sampling proportional to size. The town of Bahirdar is divided into 2 Weredas and 17 Kebeles. The Kebeles were considered as strata. A sample was selected from each Kebele by the method of systematic sampling. The number of households[1] sampled from the Kebele vary according to the household size of the Kebeles proportionally.

Considering the overall cost and time, a sample size of 2,052 (15% of 13,677) households were considered. The samples from each Kebele were drawn randomly and independently by computer.

There were altogether 1179 women respondents of reproductive age (15-49) who were currently married, living with their husbands. The study was confined to currently married women in Bahirdar because the level of education of the husbands was taken as one of the explanatory variables.

The demographic, socio-economic and housing data collected by the National Urban Planning Institute are subject to certain limitations: (i) Information on the intermediate variables, which are widely known as the proximate determinants of fertility, through which the socio-economic variables influence fertility indirectly were not collected during the survey. Some examples of the proximate determinants of fertility are: Age at first marriage, breast-feeding, use of contraceptive, etc.

One of the major intermediate variables which affects the level of fertility is age at first marriage. An increase in age at first marriage contributes to a decline in fertility. This is becuase of the fact that a female who enters into marital union at younger age will be exposed for longer period to pregnancy risk than one who does so at older age, all other things being equal. The younger a women at marriage, the earlier they start childbearing and the longer they are exposed to the risk of conception.

Considerable research has been done by demographers on the contraceptive role of breast-feeding and hence the natural spacing of births. It is known that breast-feeding suppresses the ovulatory cycle of the mother and is a major source of protection against pregnancy particularly in non-contraceptive society. This is perhaps due to the fact that in some cultures breast-feeding is associated with taboos which discourage sexual intercourse. It is widely believed that the time between birth and the return of ovulation depends on the duration and intensity of breast-feeding.

(ii) The married female population of the town under study were categorized into working and non-working. Distinction between women working at home and those working far away from home in factories, etc. was not made. This distinction is of prime importance because female labour force participation will not result in low fertility unless there is greater incompatibility between the roles of mother and work[2]. Role conflict exists when women are engaged in works which take married women far from home. Therefore, these limitations should be born in mind in recognizing the limitations imposed on the interpretation of the study.

2.2 DEFINITION OF VARIABLES INCLUDED IN THE STUDY

The purpose of this study, as has been pointed out earlier, is to assess the influence of some selected socio-economic factors on fertility. By fertility we mean the number of children ever born (CEB) by a woman. CEB is taken to be the response variable (Y). The socio-economic factors (women education, women employment, ethnicity and religion) are considered to be our explanatory variables (X's). The independent variables included in the study are defined as follows:

A. Women employment

Following Mason, et al (1971), Piepmier and Adkins (1973) and Standing (1978, Chapter 7) the manner in which women's employment and childbearing relate to each other is by no means constant. Although in most industrialized countries the work intensity of wives is inversely related to the number of children they bear, this relationship is often zero or positive in the developing countries, and especially in the rural population. In this study an attempt has been made to see the relationship between women employment and the number of children they bear.

Working women are defined in this study as those who are working in the formal and informal sectors of the economy for remuneration. Non-working women are those who have never been gainfully employed outside or inside their home.

B. Education

Education is strongly related to fertility in most countries, but the form and size of the relationship vary considerably. At current fertility rates, averaged over all countries, women with seven or more years of education will bear 3.9 children while women with no schooling will bear nearly 80 percent more, that is 6.9 children on the average. Although highly educated women generally have the lowest fertility, women with a few years of schooling often have slightly higher levels than those with no education. This pattern is most common in the least developed countries.

An attempt has also been made to see the relationship between employment and fertility among female population of Bahirdar town.

The level of women education is determined in terms of the number of years of schooling completed. The survey did not actually inquire about the total number of years of education but about the highest educational level attained and the number of years completed at that level. The precise number of years is often difficult to determine for those with schooling beyond the intermediate or lower secondary level, because the number of years obtained before entrance into certain technical and high academic course can vary. In some cases, where alternative education systems coexist, the total number of years is known only approximately.

C. Religion and Ethnicity

Differences in fertility among various ethnic groups living in similar economic and environment condition have been identified (Henin, 1969; Gaisie, 1975). Religion which refers to a system of attitudes, beliefs and practices that individuals share in group, is among the institutions which affect fertility.

Information on ethnicity was obtained by asking a woman the determining question: "To which ethnic group do you belong?" Similarly the religion to which a woman belongs was obtained on inquiry concerning the religion the woman is following.

Number of children ever born is the dependent variable used in this study. The total number of children ever born alive was obtained from answers to there independent questions about the outcome of each live birth. The questions were: Of the total number of children born to you alive (i) how many were born alive but died? (ii) how many are living elsewhere? and (iii) how many are presently living with you?

The figures on total number of children ever born are usually understated, because of recall lapse. This is likely to vary with level of education, age and other factors. We have no means of estimating the level of understatement. During the survey attempts were made to reduce the level of understatement to a minimum, by including rigorous probing questions.

[1]The concept of "household" is based on the arrangements made by person, individually or in groups, for providing themselves with food or other essentials for living in the survey. A house hold may be either:

a. a one-person household, that is, a person who makes provision for his own food or other essentials for living without combining with any other person to form part of a multi-person household; or

b. a multi-person household, that is, a group of two or more person who make common provision for food or other essentials for living.

[2]R.H. CHAUDHURY. Female status and fertility behavior in a metropolitan urban area of Bangladesh. Population Studies, Vol. 32, No. 2, July 1978.

2.3 METHODS OF ANALYSIS

To asses the influence of the selected socio-economic variables on fertility of women in Bahirdar town regression analysis will be the principal method that we shall use in this study. As a second method we employ the method of averages. In Chapter IV we will briefly introduce this method and see how it can be utilized. In this section we introduce the multiple linear regression model and the common assumptions about it. A brief discussion about some of the problems one encounters when some of the assumptions of a model are violated and means of overcoming these will be given. The implications of the violations and known diagnostic methods of detecting them shall be discussed.

The analysis part of this work in Chapter IV will begin with the formulation of a general model that relates the response variable to the explanatory factors/variables. Then a model will be fitted. Having fitted the model, examination of the adequacy of the fitted model and the validity of the assumptions about the model will be made. And finally inferences based on the fitted model will be made.

The reason why we use regression analysis in this study is simply because this statistical method enables us to establish a functional relationship between the number of children ever born (CEB) and the socio-economic factors we had already introduced in Chapter I. In statistical studies the method had long become one of the most widely used tools for analyzing multifactorial and multivariate data.

Before we go further into a detailed discussion about a linear regression model we give a mathematical presentation of it, and also introduce a few relevant notations.

If an n-vector of response variable **y** and the matrix of explanatory variables **X** of dimension **nxp, p≤n**, are given then the multiple linear regression model can be written in a compact form as

$$\mathbf{y} = \mathbf{X}\beta + \epsilon , \quad E(\epsilon) = 0, \quad Cov(\epsilon) = \sigma^2 I_n ,$$

where β is a **p**-vector of fixed but unknown parameters. Note that in the model the components of the **n**-vector of random error terms are assumed to be independently and identically distributed with a zero mean vector and common constant variance $\sigma^2>0$.

If we denote the i^{th} components of **y** and ϵ by y_i and ϵ_i, respectively, and the i^{th} row of **X** by x_i', the above model can be rewritten as $y_i = x_i'\beta + \epsilon_i$, $i= 1, 2, \ldots, n$.

Without any distributional assumption we obtain the unbiased estimator of β using the method of least squares. Assuming that the **X** has full column rank the ordinary least squares estimator (LS) of β is given by $\mathbf{b} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y}$. Under normality assumption of the error vector the LS is also the maximum likelihood (ML) estimator of the regression coefficient vector β.

We denote the fitted value of y_i and estimated value of ϵ_i by $\hat{y}_i$ and e_i (also called the residual), respectively. The i^{th} standardized residual, that is the ratio of the computed residual to standard deviation, is denoted by r_i.

Once we adopt the above notations and notions we introduce some diagnostic procedures that can be used to expose gross model violations such as heterogeneity in the covariance structure, non-linearity of the model, presence of outliers, etc. Model violations can be detected by studying graphs of residuals as the violations, mostly, are reflected in the theoretical properties of the residuals and their graphical presentations. For example, if the model is a correct one, then the computed standardized residuals vector will have zero mean and unit variance. Further, for a valid specified model the standardized residuals fall between -2 to 2. Besides, the residual plots, that is plots of the standardized residuals against fitted **y**-values or the independent variables, should show no distinct systematic pattern. On the other hand, if the model is not valid the plots exhibit systematic trends, that is to say the plots do not show a random behavior. If such patterns are observed the model or some part of it may be suspect. In what follows we shall investigate the implications of different plots as well as analytical results with regard to violations of some model assumptions.

Plots of standardized residuals versus fitted values

The most important single diagnostic of detecting model violation is the plot of standardized residuals against the fitted values $\hat{y}_i$. Since the standardized residuals and the fitted values are nearly uncorrelated the null plot, the plot that is observed when the specified model is correct, might look something like Figure 2.1(a). In this Figure the points tend to fall in a horizontal band, without any apparent systematic features.

Plots of standardized residuals versus independent variables

Like the fitted values, the standardized residuals and each of the independent variables are nearly uncorrelated, and systematic features in these plots would suggest model failures that are a function of the independent variable. For instance, Figure 2.1(b) suggests that the residual variance is an increasing function of the independent variable.

Heterogeneity in the covariance matrix structure

If the components of the error vector have a common constant variance, then we would expect the variability of the residuals to be fairly uniform. This is indicated by a plot as in Figure 2.1(a) which roughly represents a "band" of uniform width. However, if the residual plots are like those of Figures 2.1(b) and (c), then there is a strong indication that the error variance is a systematic function of the quantity plotted in the horizontal axis. Residual plots like in Figure 2.1(b) should be expected when there is a strong dependency of residual variance on the dependent and explanatory valriables. The situation in Figure 2.1(c) is implied obviously when small values of an independent variable and/or of the fitted y-values are causes for large variability and vice versa.

If heterogeneity in the covariance structure is suspected, and it is known that the variance of $\mathbf{e}_i$ is a known function of some quantity, then weighted least squares is recommended as a remedy that can lead back to a constant variance.

Non-linearity

One of the standard assumptions made in regression analysis is that the model which describes the data is linear in its parameters. But not all relationships between a response variable and its predictors are linear. Non-linearity can often be discovered by examining plots of the standardized residuals. In general, non-linearity will be indicated by a curved trend in the residual plots as shown in Figures 2.2(a)-(d).
When there is indication of non-linearity the principal

remedies of obtaining a linear model out of the non-linear one are transformations. It should be remarked, however, that there are non-linear models which cannot be linearized by transformations. Here we do not need to go into details of this subject matter.

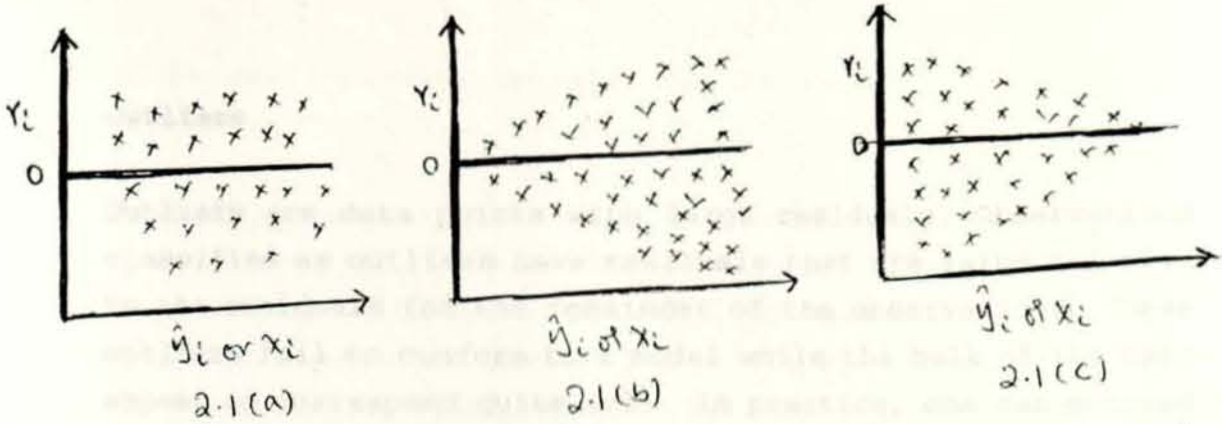


Figure 2.1 Residual plots (a) Null plot. (b) Right-opening. (C) Left-opening

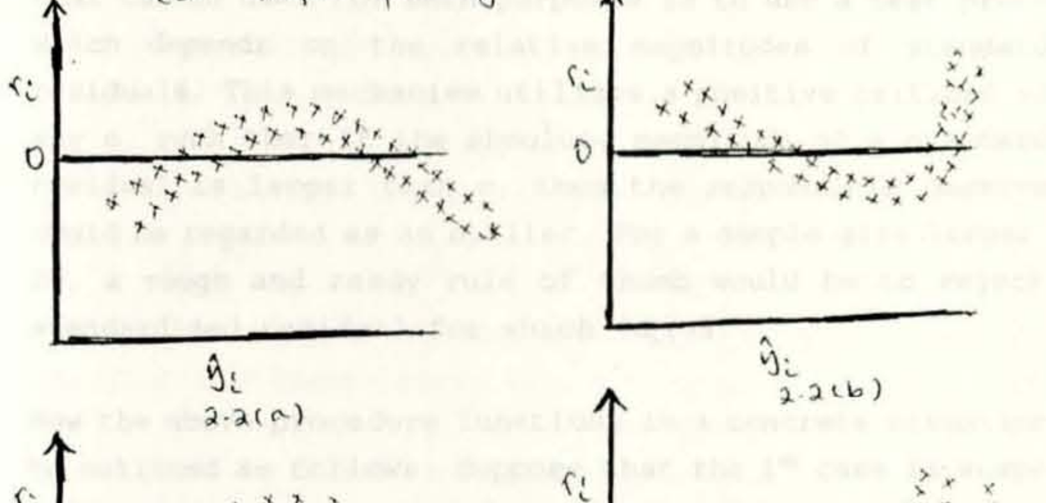


Figure 2.2 Residual plots (a) and (b) Non linearity. (c) and (d) Non linearity and non constant Variance.

Outliers

Outliers are data points with large residuals. Observations classified as outliers have residuals that are large relative to the residuals for the remainder of the observations. These outliers fail to conform to a model while the bulk of the data appear to correspond quite well. In practice, one can proceed with the .analysis of the data if the outliers can be identified, and then discarded from the data-set. One method that can be used for such purposes is to use a test procedure which depends on the relative magnitudes of standardized residuals. This mechanism utilizes a positive critical value, say **c**, such that if the absolute magnitude of a standardized residual is larger than **c**, then the responsible observation could be regarded as an outlier. For a sample size larger than 20, a rough and ready rule of thumb would be to reject any standardized residual for which $|d_i|>3$.

How the above procedure functions in a concrete situation can be outlined as follows: Suppose that the i^{th} case is suspected to be an outlier. A useful test rule would be to compare the quantity

$$t_i = r_i \, [(n-p'-1)/(n-p'-r_i^2)]^{1/2}, \quad i=1,2, \ldots, n$$

with a critical value obtained from Table D in Weisberg (1980, pp. 264-267). **p'** in the above expression is the number of independent variables plus one if a column of ones is included in the model. To use Table D, we select an α-level (either 0.01 or 0.05) and enter the Table in the row corresponding to the sample size **n** and the column corresponding to the number of parameters **p'**. If the absolute value of a computed t_i value, i=1,2, ..., n, exceeds the critical value, then this is evidence that the case is an outlier. It should be remarked that discarding outliers is not always useful, and sometimes there are instances where it can be regarded as an unwise measure.

Influential case

In some data-sets, one of the cases may have a decisive impact upon the regression such that, if the case were not in the data, completely different results would be obtained. Such cases that lead to quite different estimates will be called influential.

In the context of case analysis, we are interested in the change in the estimate of ß when a case is deleted from the data. A case will be called influential if deleting it results in a substantial change in the estimate of the parameter vector.

One of the measures of influence of a case on regression is the Cook's distance given by

$$D_i = [(b_{-i} - b)'X'X(b_{-i} - b)]/p's^2 \text{ , } i=1, 2, \ldots, n,$$

where b_{-i} is the least squares estimate of ß obtained from the regression using all the cases except the i_{th}, and s^2 is the unbiased estimator of σ^2. Typically, cases with observed values of $D_i>1$ may be judged as influential cases. We will utilize Cook's distance to our data to check the presence of influential cases.

Checking for normality and lack-of-fit

For inferential purposes it is natural to assume normality of the error vector. To establish evidence for normality examining the residuals is of no great use. Instead we study it using the so-called normal probability plot. If the population from which the sample is taken is not normal, the plot should not approximate a straight line. A remedy for getting rid of non-normality is transformation of the dependent variable.

Another aspect in regression analysis is whether the fitted model is an appropriate one or not. To examine a lack-of-fit in the linear model which will be fitted using children ever born as the dependent variable and the socio-economic factors as explanatory variables, we will make use of pure error. Pure error is obtained by using repeated sampling of cases with identical values of independent variables. From the values of $\mathbf{y}_i$ corresponding to a group of identical $\mathbf{x}$-values we can estimate the average response and standard deviation. If it is assumed that the variance is constant for all $\mathbf{x}$-values, a pooled estimate of this variance is obtained by adding the sum of squares within a group; and it is this sum that we call pure error. Dividing the pure error by its degrees of freedom will give us the pooled estimate of variance, estimated without reference to the fitted model.

If a linear regression model is fitted, the residual sum of squares we obtain from Analysis of Variance (ANOVA) Table provides an estimate of σ^2 that depends on the model. Thus we have two estimators of σ^2 and, if the estimator of σ^2 obtained using the model is much larger than that which is obtained without using the model, then the model does not fit.

The test statistic which has an F-distribution under normality can be obtained by dividing the residual sum of squares into sum of squares of pure error and sum of squares due to lack-of-fit, and taking the ratio of the mean square for lack-of-fit to the mean square for pure error. If the observed value of F is smaller than the tabulated one (for a specified α-level), then there will be no lack-of-fit.

CHAPTER III
POPULATION CHARACTERSTICS

3.1 AGE COMPOSITION

Data on age composition is of fundamental importance for measuring potential manpower, potential school-age population, etc. Information on the age structure of population is required for preparation of current population estimates and projection. The study of mortality and fertility also needs information on the age structure of the population.

3.1.1. SINGLE YEAR AGE DISTRIBUTION

According to the sample survey conducted in Bahirdar town the percntage distribution of the population by single year of age is presented in figure 3.1.1. A glance at this fi gure reveals some obvious regularities as the age distribution fails to have a descending pattern as age increases because of heaping at ages ending in 0 and 5. To help us confirm the presence of age heaping at particular terminal digits we employ the Whipple's index which measures digit preference.

Whipple's Index is an index developed for measuring preference for or avoidance of a particular terminal digit. This index for terminal digits "0" and "5" Combined varies between 100, representing no preference for "0" and "5", and 500, indicating that only digits "0" and "5" were reported. The index for male and female population of Bahirdar town was calculated to be 248 and 283, respectively. The figure for females shows considerable preference for ages with terminal digits 0 and 5 than for males indicating age data for females to be less accurate than for males.

Trend of population by age.

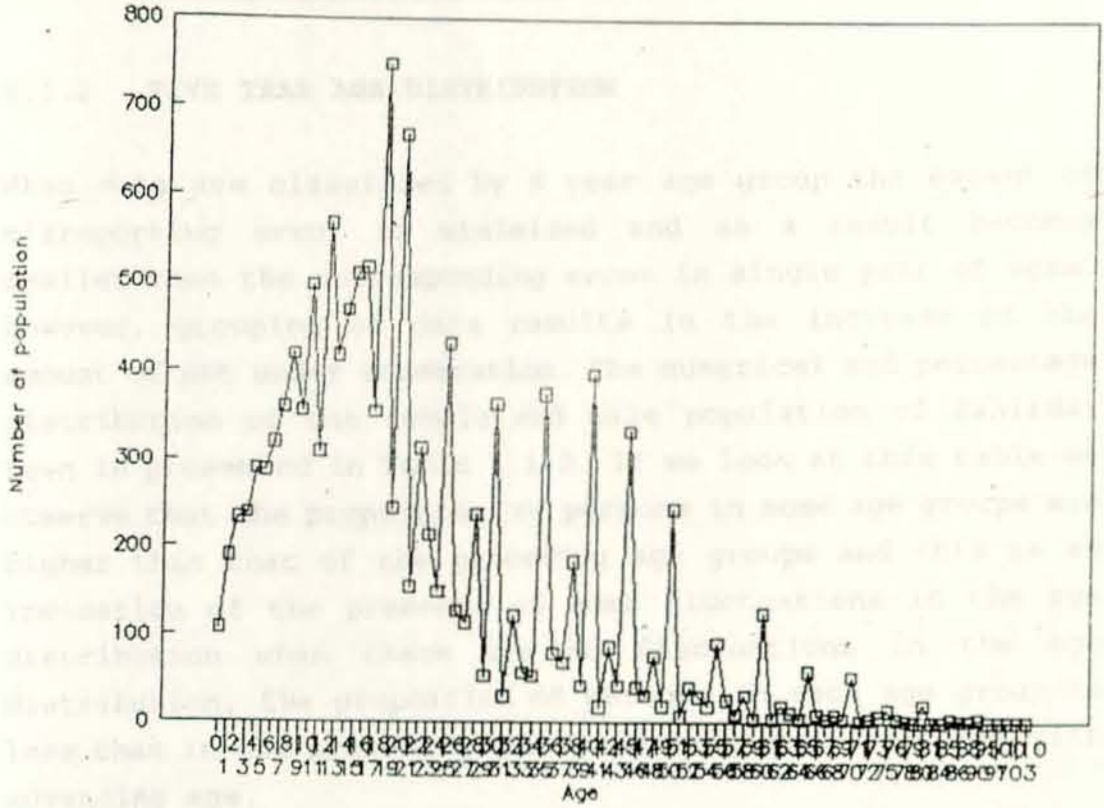


Table 3.1.1 Whiple's Index by Sex

Sex	Index
Male	248
Female	283

3.1.2. FIVE YEAR AGE DISTRIBUTION

When data are classified by 5 year age group the extent of misreporting error is minimized and as a result becomes smaller than the corresponding error in single year of ages. However, grouping of data results in the increase of the amount of net under enumeration. The numerical and percentage distribution of the female and male population of Bahirdar town is presented in Table 3.1.2. If we look at this table we observe that the proportion of persons in some age groups are higher than that of the preceding age groups and this is an indication of the presence of some fluctuations in the age distribution when there are no fluctuations in the age distribution, the proportion of persons in each age group is less than in the preceding one since mortality increases with advancing age.

Table 3.1.2 Percentage Distribution of the population by 5 years Age Group.

Age-Group	Male %	Female %
0 - 4	8.78	7.35
5 - 9	14.48	12.10
10 -14	17.75	16.5
15 -19	15.69	19.82
20 -24	10.94	11.67
25 -29	6.66	7.87
30 -34	4.30	5.05
35 -39	4.68	6.48
40 -44	4.50	4.16
45 -49	4.79	2.93
50 -54	3.01	2.22
55 -59	1.46	1.04
60 -64	1.20	1.30
65 -69	0.82	0.52
70 -74	0.44	0.56
75 -79	0.22	0.14
80 -84	0.15	0.19
85+	0.17	0.11

The Age-Ratio analysis has been employed to evaluate the grouped data under discussion.

The Age-Ratio is defined as the ratio of the population in the given age group to one-third of the sum of the population in the age group itself and the preceding and subsequent groups, times 100. In the absence of extreme fluctuations in past birth, death or migration, the three age groups should from a nearly linear series. Age ratio should then approximate 100.0, large deviation from 100 denoting net age misreporting. Table 3.1.3 shows the age ratio by five year age-group and sex. High positive deviation for an age group indicates the number of persons who erroneously reported their age in to this age group to be more than those who erroneously reported out of the same age group. For instance the corresponding deviation for females in age-group 15-19 is 23.9 showing excess of females who erroneously reported their age into this age group compared to those who erroneously reported out of the group. This is confirmed by the presence of more females in this age-group than the age-group 10-14 which is contrary to the fact that population distribution tends to have descending pattern as age increases. On the other hand high negative deviation for an age group indicates the number of persons who erroneously reported their age into this age group to be less than those who erroneously reported out of the same age group. The age group 20-24, 25-29, 30-34, 40-44, 45-49, 55-59, 65-69 and 75-79 for female population have negative deviations.

Table 3.1.3 Age-Ratio by 5 Year Age-Group and Sex

Age	Male		Female	
Group	Ratio	Deviation	Ratio	Deviation
0-4				
5-9	105.7	5.7	100.9	0.9
10-14	111.2	11.2	102.3	2.3
15-19	106.1	6.1	123.9	23.9
20-24	98.6	- 1.4	89.0	-11.0
25-29	91.2	- 8.8	96.0	- 4.0
30-34	82.0	18.0	78.1	-21.9
35-39	101.9	1.9	124.0	24.0
40-44	96.6	- 3.4	91.9	- 8.1
45-49	116.7	16.7	94.5	- 5.5
50-54	97.6	- 2.4	107.3	7.3
55-59	77.0	-23.0	68.9	-31.1
60-64	103.8	3.8	135.6	35.6
65-69	100.0	0.0	65.9	-34.1
70-74	88.6	-11.4	138.2	38.2
75-79	81.3	-18.7	46.2	-53.8
80-84	88.4	-15.6	131.3	31.3
85+				

3.2. SEX COMPOSITION

The classification of population by sex is of great importance in demographic study. For instance the evaluation of the accuracy of census or survey data requires the tabulation of data by sex. The study of fertility of a given population requires separate data of females. The numerical measures of sex composition are:

1. Masculinity proportion
2. Sex-Ratio and
3. Ratios of the excess or deficit of male to the total population.

   Here we consider only the second one which is the sex ratio.

3.2.1. OVER ALL SEX RATIO

The sex ratio is often defined as the number of males per 100 females. A sex ration above 100 indicates an excess of males and a sex ratio below 100 denotes an excess of females. The over all sex ratio for Bahirdar town is calculated to be 82.5 showing an excess of females. Under normal circumstance the number of males are expected to be equal to that of females. I.e, the over all sex ratio is expected to be 100.

3.2.2. SEX RATIO BY AGE GROUP

The sex ratio by five year age group is presented in table 3.3.2. The pattern of the age specific sex ratios of the population of the town deviates from the normal pattern. Under normal circumstance the sex ratio tends to be high at the very young ages and then tends to decline with advancing ages because of higher mortality of males at older ages and excess of males among births and children. But the sex ratio of the town deviates from the normal pattern as some of the sex ratios at young ages are lower than at old ages.For instance the sex ratios in the age groups 0-4 up to 40-44 are lower than the sex ratios in each of the age groups 45-49, 50-54 and 55-59.

Table 3.2.2 Sex ratios by age group

Age group	sex_ratio
0-4	98.50
5-9	98.18
10-14	88.42
15-19	65.14
20-24	77.12
25-29	69.58
30-34	70.03
35-39	59.45
40-44	89.07
45-49	134.27
50-54	111.80
55-59	114.47
60-64	76.59
65-69	128.95
70-74	63.41
75-79	130.00
80-84	64.28
85+	125.0

3.3 Ethnic Composition

The percentage distribution of the population of Bahirdar town by ethnic group is presented in Table 3.3. As can be seen from the table almost all of the residents of the town, namely 92%, are from "Amhara" ethnic group. The percentage contributed by "Tegray" and "Oromo" was 5.1 and 0.5 respectively. Out of the 43 ethnic group in the sample population the remaining 40 ethnic groups taken together constitute about 7% of the total population.

Table 3.3 Percentage Distribution of the Population by Ethinicty.

Ethnic group	percent
Amhara	91.50
Tigray	5.10
Oromo	0.50
Others	2.90
Total	100.00

The percentage distribution of the female married population under study by ethnic group is given in Table 3.3.1. The table shows the percentage distribution for Amhara and other ethnic groups taken together this is because that when the other groups are taken separately each constitute less than 1 percent of the married female population.

Table 3.3.1 Percentage distribution of married female in the Age group 15-49 by ethnicity.

Ethnic group	percent
Amhara	92.60
Others	7.40
Total	100.00

3.4 <u>Religious Composition</u>

The population of Bahirdar town is dominated by the followers of the religion christian. About 90% of the population of the town are christians. Muslims forms only about 10% of the population. Table 3.4 presents the percentage distribution of the population by religion.

Table 3.4 Percentage distribution of the population by religion

Religion	Christian	Muslim	Total
percent	89.90	10.10	100.00

The percentage distribution of currently married female population in the reproductive age group (15-49) by religion is shown in Table 3.4.1. As it is evident from this table the largest proportion (89.90%) of the females are followers of christianity.

Table 3.4.1 Percentage distribution of married female population in the age group 15-49 by religion

Religion	Christian	Muslim	Total
percent	89.60	10.40	100.00

3.5 Educational and labour force characteristics

The percentage distribution of the town aged 7 years and above by educational attainment is given in table 3.5. The population has been classified into two broad categories. These are : (1) illiterate and (2) literate. The literate group consists of those who can read and write only and those in the primary, secondary and post secondary level of education. A glance at Table 3.5 reveals that of the total population aged 7 years and above, about 16 percent are illiterate while the remaining population (84 percent) are literate.

A further split of the literate into population with grade level 1-3, 4-6 and 7 and above is presented in Table 3.5.1. It should be noted , however, that those people who can read and write only are included in the grade level 1-3. About 45 percent are with grade level 7⁺, the percentage of population with grade level 1-3 and 4-6 are equal each constituting about 20 percent.

Table 3.5 percentage distribution of the population by educational attainment (broad category)

Educational attainment	percent
illiterate	16.10
literate	83.90
Total	100.00

Table 3.5.1 percentage distribution of the population by educational attainment

Educational attainment	percent
illiterate	16.10
1 - 3	19.60
4 - 6	19.60
7⁺	44.60
Total	100.00

Table 3.5.2 presents the numeric and percentage distribution of the study population that is the currently married female population in reproductive age group (15-49) by age and educational attainment. The table shows the study population classified as illiterate and literate the literate group being subdivided into three sub-groups. The subgroups are: 1-3, 4-6 and 7⁺ containing population with grade level 1-3, 4-6 and 7⁺, respectively. About 19 percent of the females are illiterate and 81 percent literate. Among the females who are literate 30, 22 and 29 percent are with grade level 1-3, 4-6 and 7⁺ , respectively. In each of the categories the largest concentration of women are between ages 35-39.

Table 3.5.2 Percentage distribution of married females by age and educational attainment.

	Educational attainment				
	illiterate	literate			Total
		1-3	4-6	7⁺	
age group	N°.	N°.	N°.	N°.	N°.
15-19	9	6	6	5	26
20-24	14	17	14	53	98
25-29	48	57	34	115	254
30-34	36	63	54	67	220
35-39	54	100	75	69	298
40-44	38	70	49	21	178
45-49	28	38	30	9	105
Total	227	351	262	339	1179

Information concerning labour force participation of the population of Bahirdar town was collected for those who are aged 10 years and above. Table 3.5.3 shows the percentage distribution of the population by employment status (employed and unemployed). Population in the employed group includes those working in the paid sector, the unpaid family workers and the self-employed or own account workers. As can be seen from Table 3.5.3 about 34 and 66 percent of the population aged 10 years and above are accounted for by the employed and unemployed groups, respectively.

Table 3.5.3 Percentage distribution of the population of Bahirdar town by employment status

category	percent
employed	34.10
unemployed	65.90
Total	100.00

The numerical distribution of the married female population in the reproductive age group (15-49) by age group and employment status is presented in Table 3.5.4. It is obvious from this table that about 66 percent of the females are unemployed and 34 percent are employed. The largest concentration of women in the employed and unemployed category are found in the age group 35-39 and 25-29, respectively.

Table 3.5.4 Percentage distribution of the married female population by age group and employment status

	employment status		
	employed	unemployed	Total
age group	N°.	N°	N°.
15-19	0	26	26
20-24	15	83	98
25-29	68	186	254
30-34	87	133	220
35-39	114	184	298
40-44	71	107	178
45-49	47	58	105
Total	402	777	1179

CHAPTER IV

DATA ANALYSIS AND FINDINGS

In this chapter an attempt will be made to present results obtained through the examination of the influence of socio-economic factors on fertility(children ever born) of the women of Bahirdar town. The socio-economic factors included in the study are: (1)wife's education, (2)husband's education, (3)wife's employment, (4)religion, (5)ethnicity and (6)household income. As it has been mentioned in the previous chapter the method of analysis employed to study the influence of the said socio-economic variables on fertility is the multiple linear regression analysis. Before applying this method to our data we will try to see the relation ship between this explanatory variables and fertility by computing simple averages.

4.1.1 EDUCATION AND FERTILITY

Education is strongly related to fertility in most countries[1], but the form and size of the relationship vary considerably.At current fertility rates,averaged over all countries, women with no schooling will bear nearly 80 percent more children than those with 7 or more years of education. Although highly educated women generally have the lowest fertility, women with a few years of schooling often have slightly higher level than those with no education. This pattern is most common in the least developed countries.

Studies made by different researchers, say for instance Simon(1974), De Tray(1976), present evidence that education is inversely associated with fertility.

For the purpose of the present study the population under study were classified into two categories, namely literate and illiterate. For each category mean CEB was computed. This value for illiterate and literate were found to be 4.52 and 4.43, respectively. This value for illiterate is slightly higher than that of literate (see Table 4.1.1).

The (average) mean CEB by age group and educational attainment is shown in the same table. The values for illiterates were higher in the age groups 15-19, 20-24, 30-34 and 35-39 than that of literate, while these values were lower in the remaining age groups.

Table 4.1.1 shows the mean CEB by age group for literate group split into women with grade level 1-3, 4-6 and 7 and above. The computed mean CEB for the women with grade level 1-3, 4-6 and 7' were 5.38, 4.94 and 3.04, respectively. This indicated that fertility is inversely related with level of education among females who are literate.

A glance at the same table revealed that for each of the age groups, except the age group 45-49, where the mean CEB for women with grade level 7' is slightly larger than that of the group of women with grade level 4-6, the mean CEB decreases with increasing level of education.

Table 4.1.1 Mean children overborne by age group and educ tional attainment

age group	Illiterate	Literate 1-3	4-6	7+	total	Total
15-19	0.56	1.00	0.33	0.20	0.53	0.54
20-24	1.93	1.76	1.71	1.00	1.27	1.37
25-29	2.40	3.32	3.26	2.29	2.73	2.67
30-34	4.58	4.29	4.24	3.81	4.10	4.18
35-39	5.63	6.45	5.41	4.10	5.47	5.50
40-44	6.21	6.80	6.53	5.52	6.51	6.45
45-49	6.25	7.21	6.73	6.78	6.97	6.78
Tota	14.52	5.38	4.94	3.04	4.43	4.45

4.1.2 FEMALE EMPLOYMENT AND FERTILITY

In many countries of Asia, Latin America and the Caribbean, women in modern occupations bore some what fewer children on the average than women with no recorded economic activity. In Africa, however, no such relationship is observed. The existence and strength of the relationship between occupation and fertility are clearly linked to level of socio-economic development. While a strong and consistent negative relationship was observed between employment in modern occupation and fertility in more developed countries, that was not the case among the poorer countries.

Mason et al (1971), Piepmeier and Adkins (1973) agree with the foregoing and conclude that the manner in which women's employment and child bearing relate to each other is by no means constant. Adding they said that although in most industrialized countries the amount of wives-work is inversely related to the number of children they bear this relationship is often zero or positive in the developing countries, especially with in their rural population. This situation leads to the expectation that with modernization, relationship between female employment and child bearing will become increasingly negative.

Result of studies by some researchers (Kasarda, 1971 and Oswa, 1988) suggests that there exists an inverse relationship between women's work and fertility provided that there is greater incompatibility between the roles of mother and worker.

Regarding the present study, the married women in the reproductive age group(15-49) were classified in to working and non-working categories. Table 4.1.2 shows the mean children everborne for each category. This table provides figures that are against expectations since this value for the women in the working category is larger than that of the not working. When we examine the age specific mean CEB we find the value to be larger in the age groups 15-19, 20-24, 25-29 and 35-39 for not working women than the corresponding value for the working women. For the remaining age groups (30-34, 40-49 and 45-49) the value was found to be lower.

This situation, that is, the presence of higher fertility among the working women than the not-working women though the difference is not substantial, may be attributed to the fact that most of the women in the working category may have been engaged in activities which don't take them away far from their home. If such is the case there will not be conflict between the roles of mother and work. Therefore , their fertility may happen to be equal or greater than that of non-working women.

Table 4.1.2: Mean CEB by age group and employment

age group	Working	Not-Working	Total
15-19	0.00	0.54	0.54
20-24	0.73	1.48	1.37
25-29	2.49	2.74	2.67
30-34	4.31	4.09	4.18
35-39	4.96	5.83	5.50
40-44	6.56	6.37	6.45
45-49	6.81	6.76	6.78
Total	4.74	4.29	4.45

4.1.3 RELIGION, ETHNICITY AND FERTILITY

The married female population of the town under study who are in the productive age-group (15-49) were classified in to muslim and christian. Table 4.1.3 presents the mean CEB for the two categories. This value for the muslim(4.68) is larger than that of the christian(4.42), however, the difference is not substantial.

Table 4.1.3 Mean CEB by Religion

Category	mean CEB
muslim	4.68
christian	4.42
Total	4.45

Regarding ethnicity the women were classified into two groups: the Amhara and another group consisting women belonging to various ethnic group other than Amhara. The reason for lumping together women of various ethnic groups other than Amhara into one category is that this ethnic groups taken separately constitute only less than one percent of the population under study.

The mean CEB for the two groups is shown in Table 4.1.3. The values for the Amharas and the other groups taken together was computed to be 4.44 and 4.48, respectively. There seems to exist no substantial difference in fertility between these two groups, though the value for the Amhara is slightly lower than that of the other groups taken together.

Table 4.1.3.1 Mean CEB by Ethnicity

Category	mean CEB
Amhara	4.44
Others	4.48
Total	4.45

So far we have seen the results of the analysis obtained using simple averages. In what follows we shall see the results of fitting multiple linear regression model to our data. The relationship between the number of children ever born to ever married women and the selected socio-economic variables was examined by controlling age of the women under study. A total of 1179 ever married women who are currently living with their husbands were interviewed during the survey. And they were classified by five year age group. Then a multiple linear regression model connecting the dependent variable (CEB) and the six explanatory variables were fitted for each age group. The model fitted for each of the age group is given as follows:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + u$$

where Y denotes the number of children ever born to a woman in the reproductive age group, X_1, X_2 and X_4 are categorical variables representing religion, ethnicity and employment respectively. Each categorical variables defines two dummy variables 1 and 0 to represent two categories. X_3 and X_5 denote number of years of schooling for wives and husbands respectively while X_6 denotes house hold income. The B_i's and u are regression coefficients and error term respectively.

Table 1 presents the results of the regression computations for the model given above for the age group 15-19. Before proceeding with the analysis our primary task will be looking at various plots of residuals to determine if there are any serious violations of the model assumptions, or some model misspecifications. First we begin with the examination of the normal probability plot. This plot is shown in Figure 1. A glance at this Figure reveals that this plot deviates from a straight line indicating that the errors are not normally distributed.

Table 1 Regression results

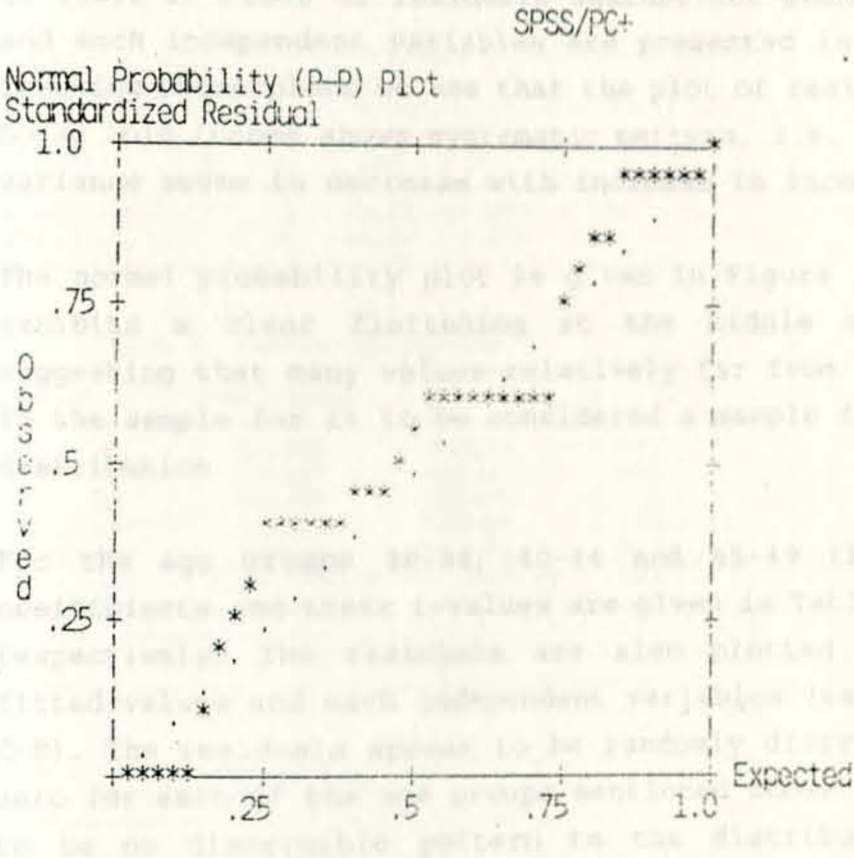
Variable	coefficient	SE	t
x1	0.494546	.653271	.757
x2	-1.981973	.921175	-2.152
x3	- .013750	.034920	- .394
x5	- .019564	.046666	- .419
x6	-4.61736E-04	.001074	- .430
Constant	2.221191	.654209	3.395

R^2 = .10 s = 0.61

Analysis of Variance

Source	DF	SS	MS	F
Regression	5	3.005	0.601	1.612
Residual	20	7.456	0.373	

FIGURE 1


SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
Expected
.25
.5
.75
1.0

The plots of the standard residuals against the fitted values and against each independent variables are shown in Appendix A. The plot of the standard residuals against the fitted values did not show a random distribution about zero. The plots for each independent variables showed no glaring indication of violation of the model assumptions.

The regression results for the age group 20-24 are summarized in Table 2. Plots of residuals against the predicted values and each independent variables are presented in Appendix B. Checking these plots we see that the plot of residuals versus house hold income shows systematic pattern, i.e. the residual variance seems to decrease with increase in income.

The normal probability plot is given in Figure 2. This plot exhibits a clear flattening at the middle of the plot suggesting that many values relatively far from the mean are in the sample for it to be considered a sample from a normal distribution.

For the age groups 30-34, 40-44 and 45-49 the estimated coefficients and their t-values are given in Table 3, 4 and 5 respectively. The residuals are also plotted against the fitted values and each independent variables (see Appendices C-E). The residuals appear to be randomly distributed about zero for each of the age groups mentioned above. There seems to be no discernible pattern to the distribution of the residuals.

Table 2 Regression results

Variable	Coefficient	SE	t
x1	0.952309	.531743	1.791
x2	- .752489	.852742	- .882
x3	- .144083	.045869	-3.141
x4	- .586522	.423058	-1.386
x5	.085054	.046415	1.832
x6	-3.74498E-05	5.74103E-04	- .650
Constant	1.569055	.938681	1.673

R^2 = .09 s = 1.42

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	32.63	5.438	2.687
Residual	91	184.14	2.024	

Table 3 Regression results

Variable	Coefficient	SE	t
x1	- .586835	.543113	-1.081
x2	.151657	.503167	.311
x3	- .058529	.055074	-1.063
x4	.630522	.361670	1.743
x5	- .069185	.048901	-1.413
x6	3.647710E-04	6.93420E-04	.526
Constant	4.996143	.683572	7.307

R^2 = .04 s = 2.197

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	67.37	11.23	2.325
Residual	213	1028.71	4.834	

FIGURE 2

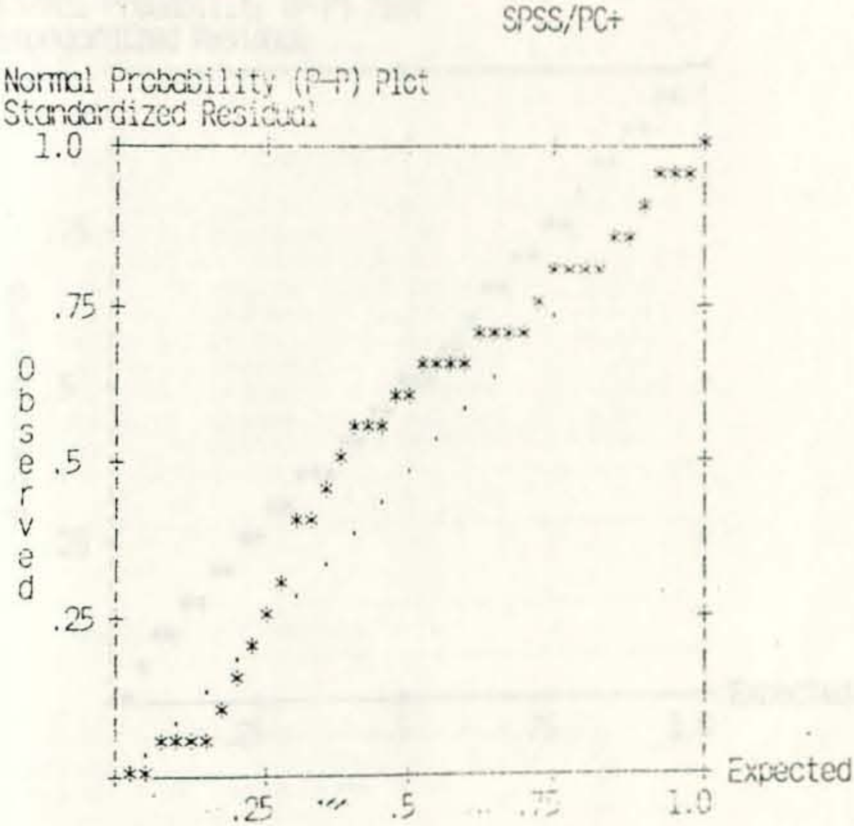

SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
Expected
.25
.5
.75
1.0

FIGURE 3

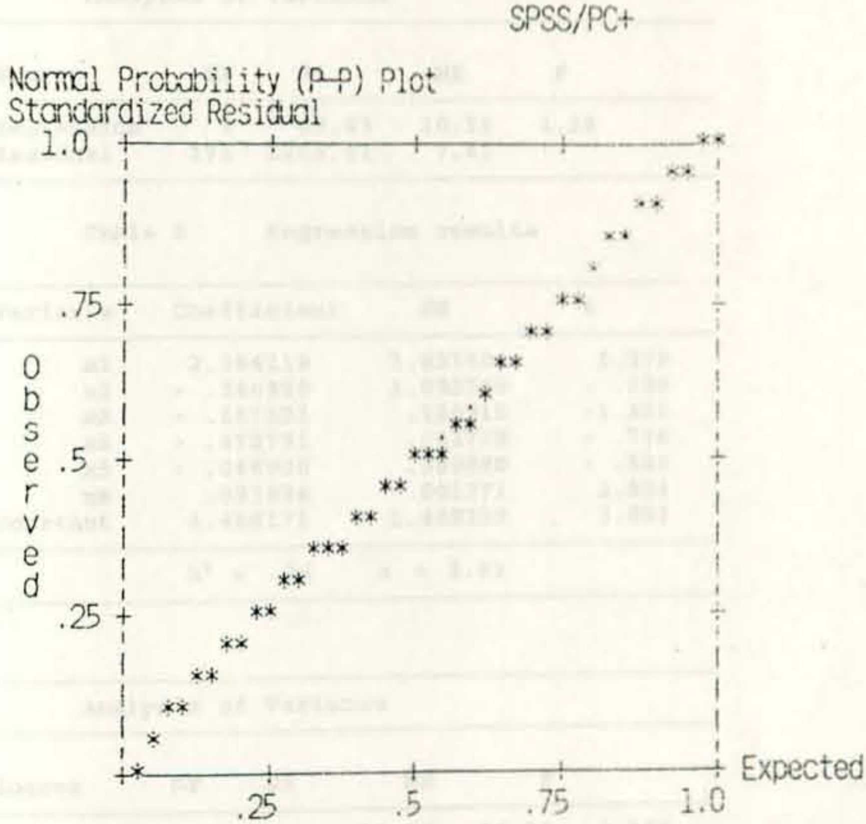

SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
Observed
.5
.25
.25
.5
.75
1.0
Expected

Table 4 Regression results

Variable	Coefficient	SE	t
x1	.493072	.682267	.723
x2	- .649610	.872610	- .744
x3	- .164675	.082886	-1.987
x4	.018247	.479915	.038
x5	- .020650	.063591	- .325
x6	.002286	.001173	1.949
Constant	6.495111	1.069125	6.075

R^2 = .01 s = 2.72

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	60.63	10.11	1.36
Residual	171	1269.41	7.42	

Table 5 Regression results

Variable	Coefficient	SE	t
x1	2.364119	1.037404	2.279
x2	- .240950	1.093768	- .220
x3	- .157521	.130915	-1.203
x4	- .472791	.642779	- .736
x5	- .046900	.089090	- .526
x6	.003854	.001371	2.804
Constant	4.488171	1.468339	3.057

R^2 = .06 s = 2.92

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	115.76	14.29	2.256
Residual	98	838.20	8.55	

FIGURE 4

SPSS/PC+

Normal Probability (P-P) Plot
Standardized Residual

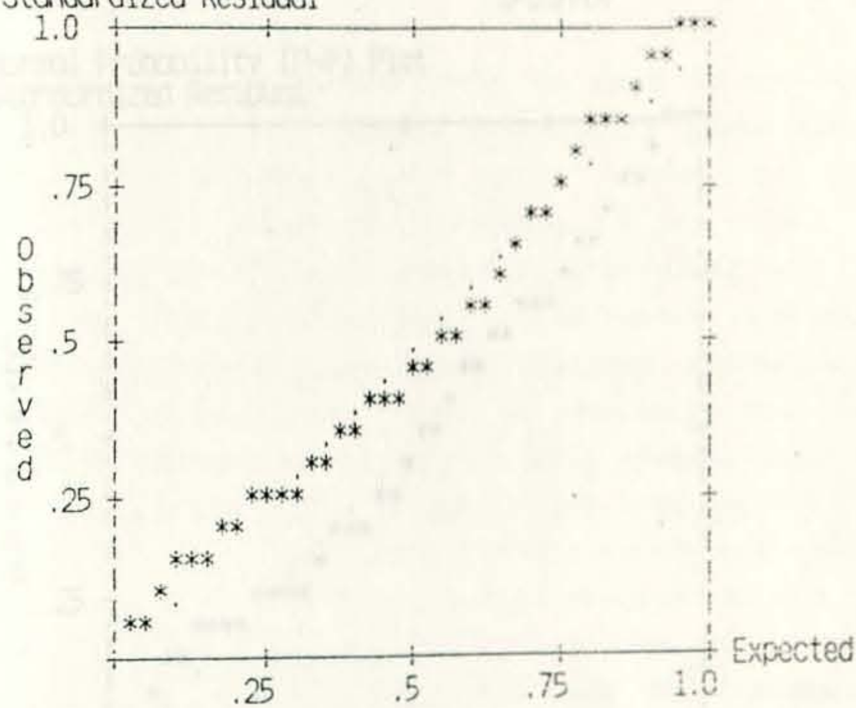
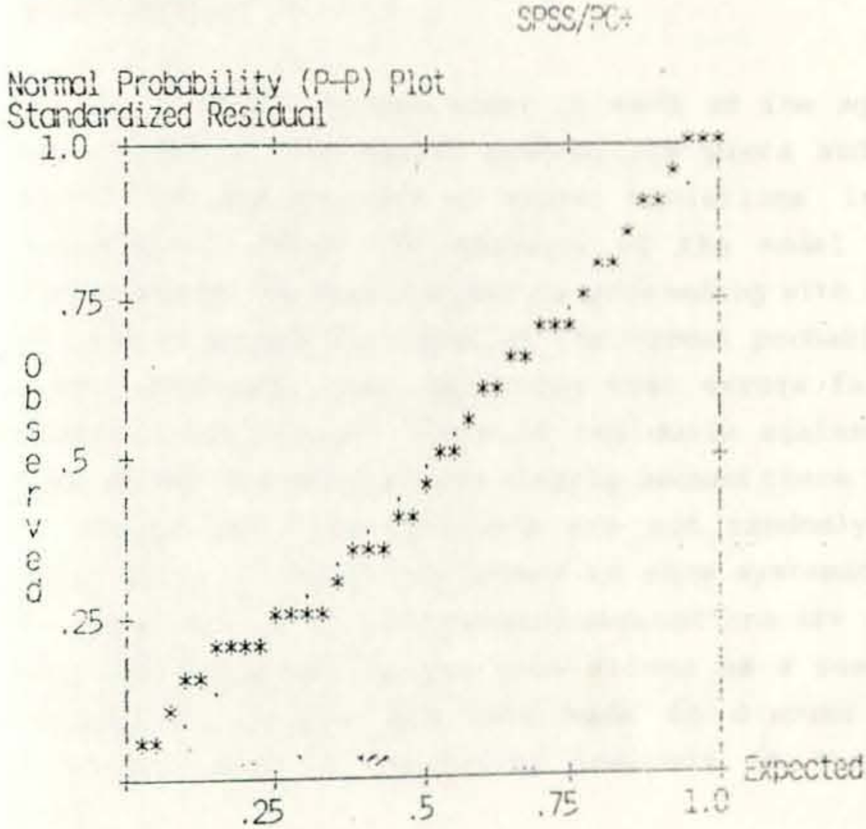


FIGURE 5


SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
Expected
.25
.5
.75
1.0

The normal probability plots for each of the age groups under consideration are shown in Figure 3, 4 and 5 respectively. These plots are nearly, though not exactly straight line.

The results of fitting models to age groups 25-29 and 35-39 appear in Table 6 and 7 respectively. From the examination of the graph of the observed standard residuals versus each independent variables (Appendices F and G) and the residuals against the fitted values, it seems the assumptions of homoskedasticity is not confirmed only when the residuals were plotted against income. The other plot and the normal probability plot (Figure 6 and 7) did not indicate serious model violation.

Having fitted a linear model to each of the age groups, we have examined the normal probability plots and the scatter plots for any evidence of gross violations in the model assumptions. Since the adequacy of the model assumptions should always be examined before proceeding with the analysis. We have observed that some of the normal probability deviate from a straight line indicating that errors fail to have a normal distribution. Plots of residuals against income for some of the age groups also clearly showed there is a problem. It seemed that the residuals are not randomly distributed about Zero, instead they seemed to show systematic features. When one or more of the standard assumptions are violated, the need for transforming the data arises as a remedy. In what follows an attempt has been made to discuss the results obtained based on regression analysis on the transformed model.

Table 6 Regression results

Variable	Coefficient	SE	t
x1	.230160	.404556	.569
x2	.476726	.449786	1.060
x3	- .019994	.034744	- .575
x4	.014952	.303164	.049
x5	- .056537	.036939	-1.531
x6	-1.98072E-04	6.18123E-04	- .320
Constant	2.664551	.591467	4.505

R^2 = .02 s = 1.82

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	37.47	6.25	1.866
Residual	247	826.74	3.35	

Table 7 Regression results

Variable	Coefficient	SE	t
x1	- .054822	.746566	- .073
x2	- .036614	.905143	- .040
x3	- .234242	.089642	-2.613
x4	- .393180	.566675	- .694
x5	.017933	.073784	.243
x6	.001115	8.68514E-04	1.284
Constant	6.215523	1.096083	5.671

R^2 = .02 s = 4.01

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	213.20	35.53	2.212
Residual	291	4673.29	16.06	

FIGURE 6

SPSS/PC+

Normal Probability (P-P) Plot
Standardized Residual

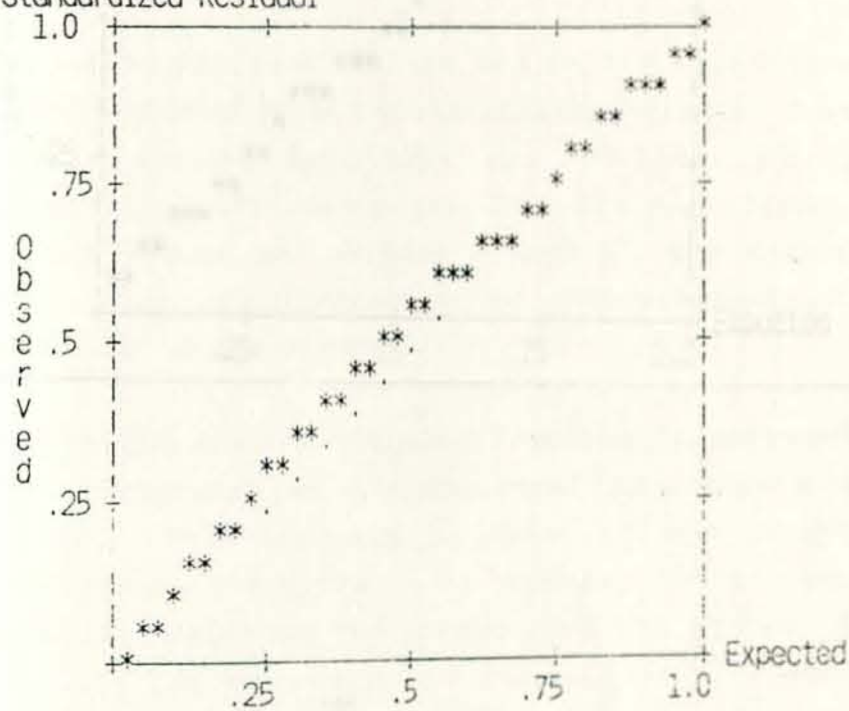
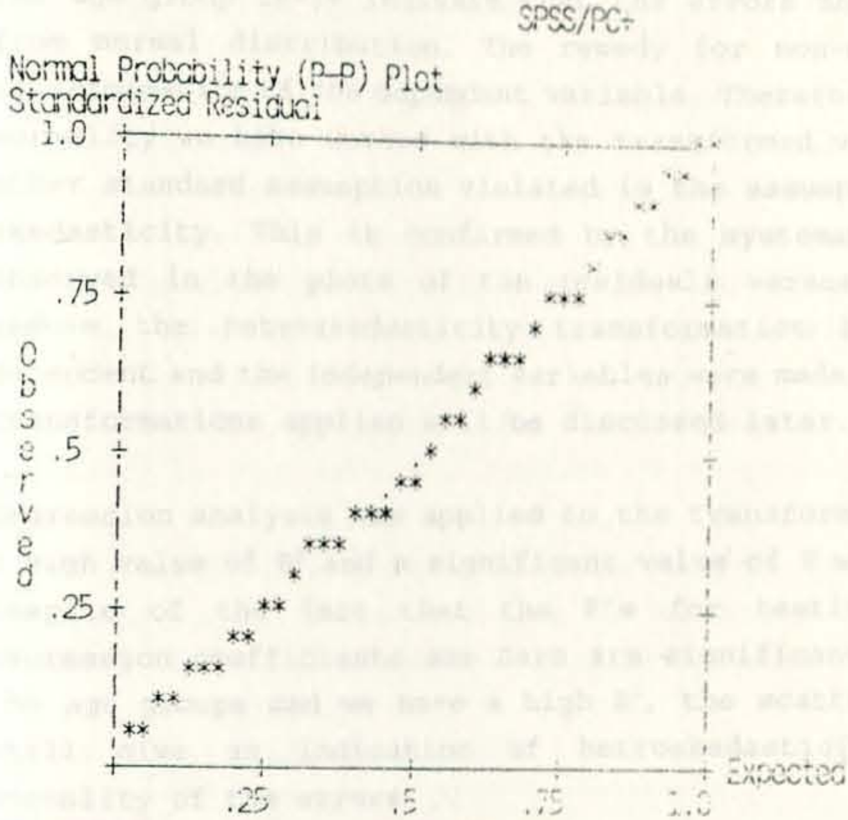


FIGURE 7



SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
.25
.5
.75
1.0
Expected

One of the standard assumptions made in regression analysis is that the errors are normally distributed. But the normal probability plots for some of the age groups for instance for the age group 15-19 indicate that the errors show departure from normal distribution. The remedy for non-normality is transformation of the dependent variable. Therefore to achieve normality we have worked with the transformed variable. The other standard assumption violated is the assumption of homo skedasticity. This is confirmed by the systematic features observed in the plots of the residuals versus income. To remove the hetroskedasticity transformation both on the dependent and the independent variables were made. The kind of transformations applied will be discussed later.

Regression analysis was applied to the transformed model and a high value of R^2 and a significant value of F was obtained. Inspite of the fact that the F's for testing that all regression coefficients are Zero are significant for all of the age groups and we have a high R^2, the scatter of points still give an indication of hetroskedasticity and non normality of the errors.

Because the results obtained from the transformed model were not satisfactory, we have continued the analysis using another approach. This approach is creating age groups which are broader than the previous age groups. The new age groups are formed by combining two consecutive age groups, for instance the first two age groups combine to give a broader age group, 15-24. The results of fitting models to the new age groups appear in Table 9 through 11. The F values for each of the age groups (Table 9 - 11) appear to be significant. The scatter plots and the normal probability plots (see Appendices H - J) for all of the age groups except the first one (15-24) and the age group 35-44 do not exhibit marked evidence of hetroskedasticity.The normal probability plot showed slight deviation from straight line for all age group except 15-24 for which the plot exhibits a clear flattening at the middle. The variations in the data explained by the model (R^2) are too small for each of the age groups.

The normal probability plot for the age group 15-24 (Figure 9) showed departure from a straight line. In the plot of the residuals versus the independent variable income, the residuals seem to decrease with an increase in income. To remove the observed hetroskedasticity and non normality our data has been transformed using suitable transformations. To achieve normality of the errors the dependent variable was transformed using square root transformation. The remedy suggested by the data for removal of hetroskedasticity was regressing Y_i/X_{6i} against $1/X_{6i}$, X_{1i}/X_{6i}, ..., X_{5i}/X_{6i}. The resulting coefficient of $1/X_{6i}$ will be an estimate of B_0, the coefficient of X_{1i}/X_{6i} will be an estimate of B_1, and so on, and the intercept from the regression will be an estimate of B_6.

Table 9 Regression results

Variable	Coefficient	SE	t
x1	.498057	.408291	1.220
x2	-1.175900	.640014	-1.837
x3	- .100463	.03373	-2.978
x4	- .332237	.354640	- .937
x5	.085725	.035496	2.415
x6	-1.29991E-05	4.68897E-04	- .028
Constant	1.749617	.666874	2.624

R^2 = .07 s = 1.21

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	22.21	3.70	2.545
Residual	114	165.79	1.45	

FIGURE 9

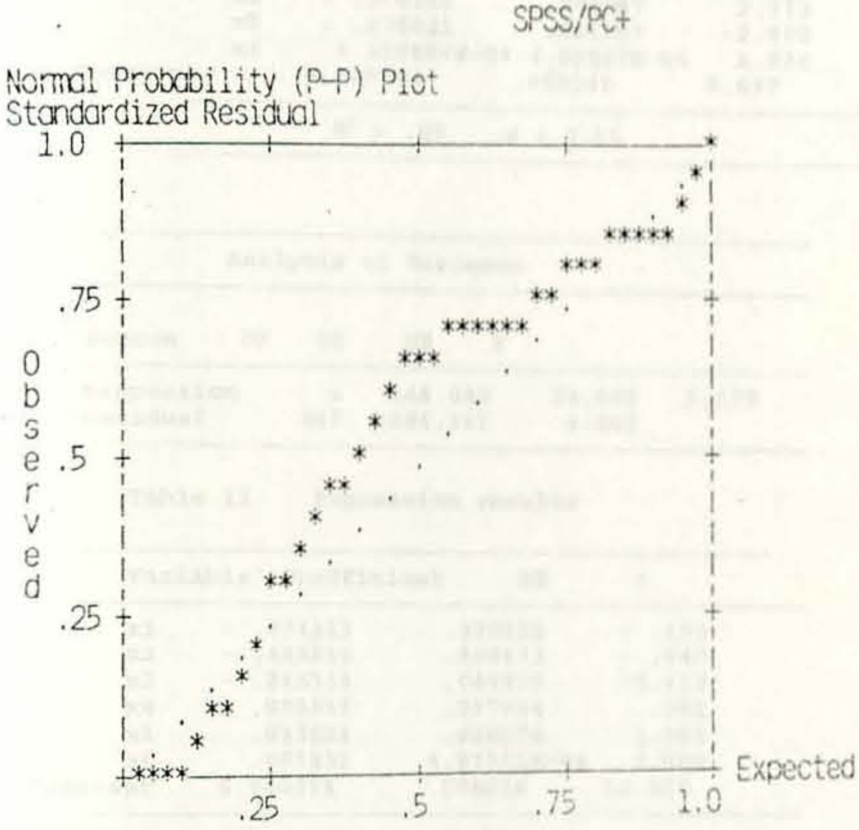

SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
.25
.5
.75
1.0
Expected

Table 10 Regression results

Variable	Coefficient	SE	t
x1	-.154110	.345533	-.446
x2	.062142	.347581	.179
x3	- .071356	.031412	-2.272
x4	- .576155	.242757	2.373
x5	- .075021	.031257	-2.400
x6	4.929656E-04	4.80508E-04	1.026
Constant	4.080784	.469242	8.697

R^2 = .05 s = 2.11

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	144.049	24.008	5.379
Residual	467	2084.341	4.463	

Table 11 Regression results

Variable	Coefficient	SE	t
x1	- .074112	.379525	- .195
x2	- .445216	.468973	- .949
x3	- .243314	.044875	-5.422
x4	.055937	.277734	.201
x5	.039604	.036570	1.083
x6	.001293	4.87311E-04	2.654
Constant	6.440274	.568916	11.320

R^2 = .06 s = 2.54

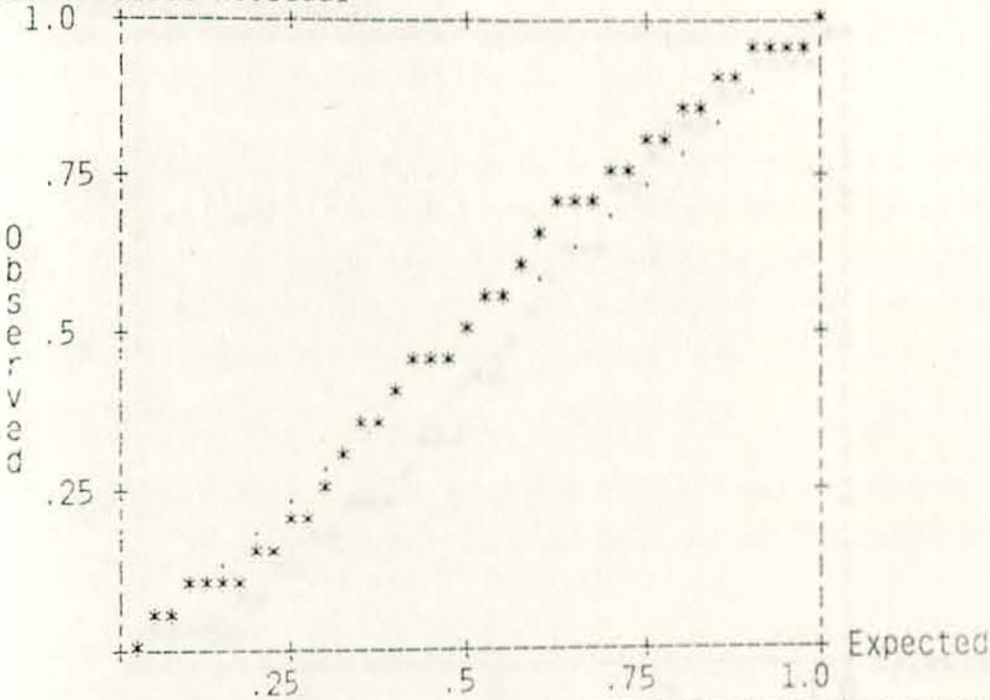
Analysis of Variance

Source	DF	SS	MS	F
Regression	6	239.73	39.96	6.17
Residual	468	3030.37	6.48	

FIGURE 10

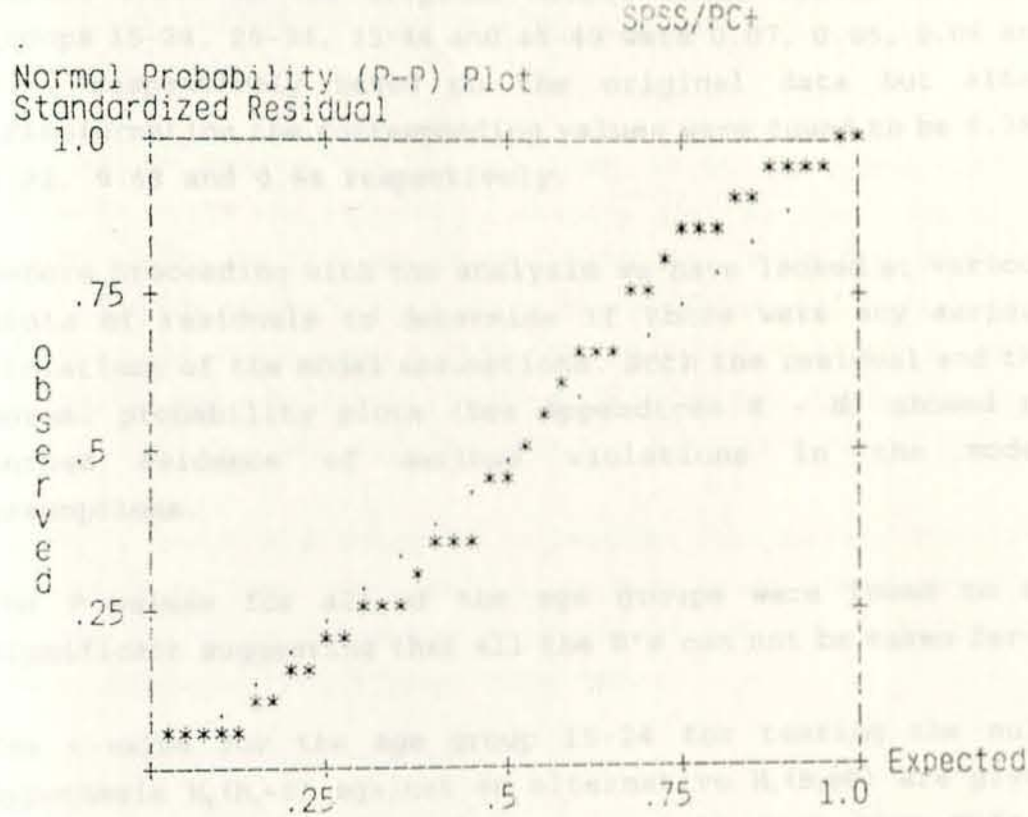
SPSS/PC+

Normal Probability (P-P) Plot
Standardized Residual



Page 60 SPSS/PC+

FIGURE 11


SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
.25
.5
.75
1.0
Expected

The results of the regression computation for the transformed appear in Table 12 through 15. The variation in the dependent variable explained by the explanatory variables (R^2) for each of the age groups are very larger than the corresponding values based on the original model. These values for each groups 15-24, 25-34, 35-44 and 45-49 were 0.07, 0.05, 0.06 and 0.06 respectively based on the original data but after transformation the corresponding values were found to be 0.38, 0.22, 0.48 and 0.64 respectively.

Before proceeding with the analysis we have looked at various plots of residuals to determine if there were any serious violations of the model assumptions. Both the residual and the normal probability plots (See Appendices K - N) showed no marked evidence of serious violations in the model assumptions.

The F values for all of the age groups were found to be significant suggesting that all the B's can not be taken Zero.

The t-value for the age group 15-24 for testing the null hypothesis $H_0(B_i=0)$ against an alternative $H_1(B_i \neq 0)$ are given in Table 12. From this Table it can be seen that Wife's education has regression coefficient that is significantly different from Zero. This value for husband's education seems to be significant when α is taken to be 0.05. As it is expected the CEB and wife's education were found to be inversely related. Though not significant the relation between women employment and fertility was also found to be negative. Contrary to our expectation, the association between fertility and husband's education was found to be positive. There seems to be no difference in fertility between the two religious and the two ethnic groups considered in this study.

A summary of regression results for age group 25-34 is given in Table 13. Here all the coefficients except those corresponding to the categorical variables X_1 and X_2 were significant. Husband's education and woman employment have showed the expected relationship to fertility whereas wife's education failed to do this showing positive relation to fertility (CEB).

Regression results for the age group 35-44 are summarized in Table 14. Like the regression results for the age group 15-24 woman education and employment seemed to have the expected relationship to fertility while husband's education did not. But here the regression coefficients for both variables, woman education and employment, were significantly different from zero while this was not true for the husband's education.

Table 15 shows a summary of regression results for the last age group (45-49). The results are similar to those obtained for the age group 25-34 except that here not all coefficients are significantly different from zero.

Table 12 Regression results

Variable	Coefficient	SE	t
x1	.037956	.020314	1.868
x2	- .048087	.032414	-1.484
x3	- .629942	.107399	-5.869
x4	- .024319	.017939	-1.356
x5	.261457	.131281	1.992
x6	3.780387	.829660	4.557
Constant	.061932	.032509	1.905

R^2 = .38   s = .06

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	.31201	.05200	13.83
Residual	116	.43604	.00376	

Table 13 Regression results

Variable	Coefficient	SE	t
x1	- .004050	.011185	- .362
x2	.017823	.011339	1.572
x3	.217752	.101715	2.141
x4	- .019781	.006941	-2.850
x5	- .725909	.097865	-7.417
x6	5.285449	.520219	10.160
Constant	.105311	.014887	7.074

R^2 = .22   s = .069

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	.66320	.11053	23.35
Residual	460	2.17776	.00473	

FIGURE 12

SPSS/PC+

Normal Probability (P-P) Plot
Standardized Residual

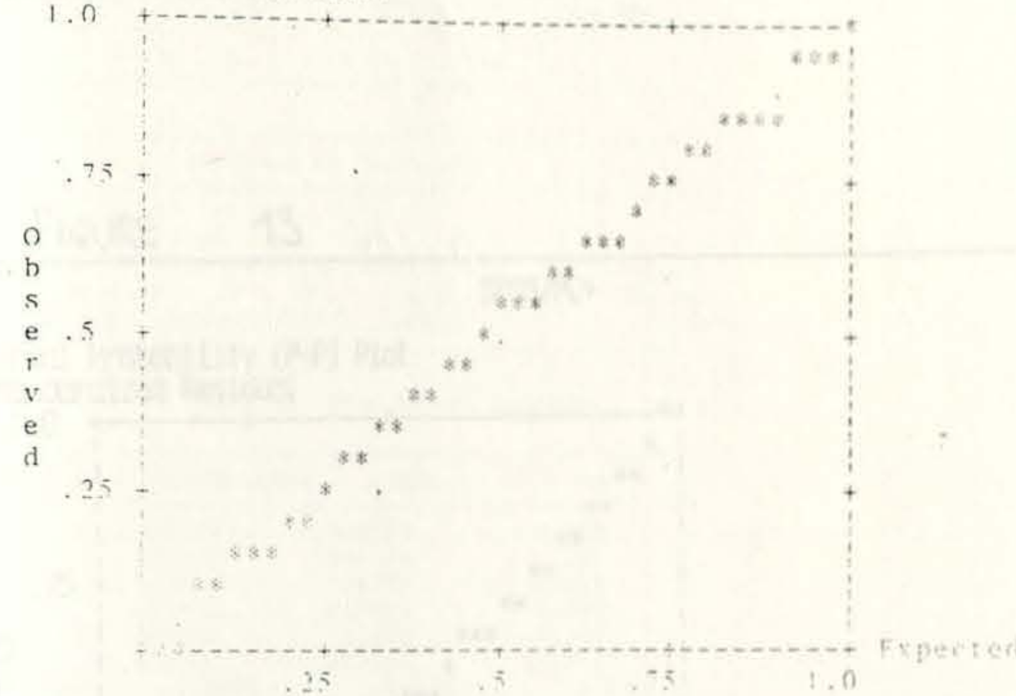


FIGURE 13

SPSS/PC+

Normal Probability (P-P) Plot
Standardized Residual

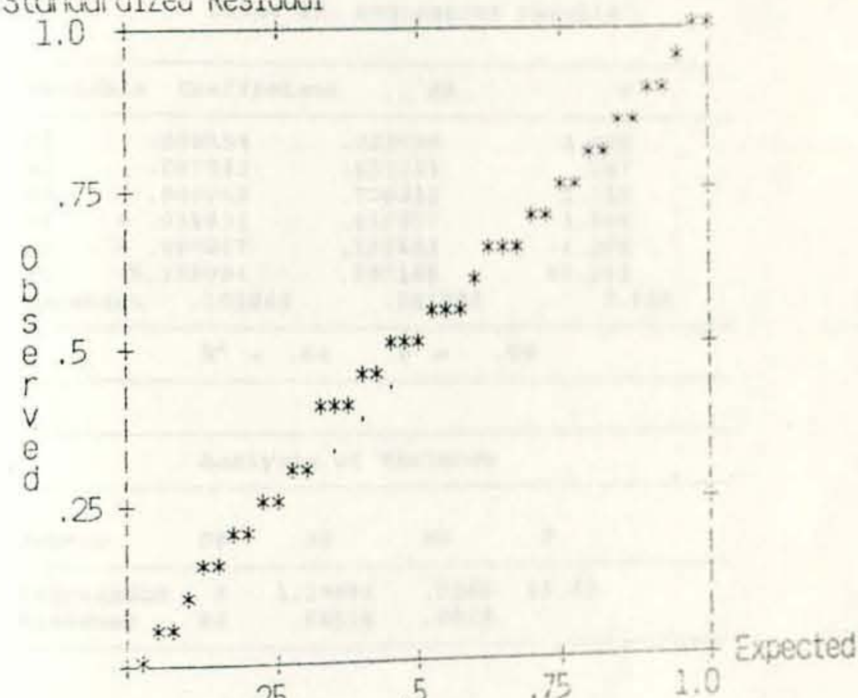


Table 14 Regression results

Variable	Coefficient	SE	t
x1	- .007438	.009110	- .816
x2	- .016958	.011804	-1.437
x3	- .515743	.165147	-3.123
x4	- .026145	.005913	-4.422
x5	2.754496E-05	.110020	.000
x6	7.650436	.478742	14.727
Constant	.161353	.014297	11.286

R^2 = .48 s = .059

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	1.526	.254	72.899
Residual	453	1.581	.003	

Table 15 Regression results

Variable	Coefficient	SE	t
x1	.060154	.029699	2.025
x2	.007592	.030731	.247
x3	.949049	.700245	1.355
x4	- .031832	.016857	-1.888
x5	- .856007	.199643	-4.288
x6	5.135094	.387166	13.263
Constant	.105866	.041380	2.558

R^2 = .64 s = .08

Analysis of Variance

Source	DF	SS	MS	F
Regression	6	1.29986	.2166	31.89
Residual	98	.66576	.0068	

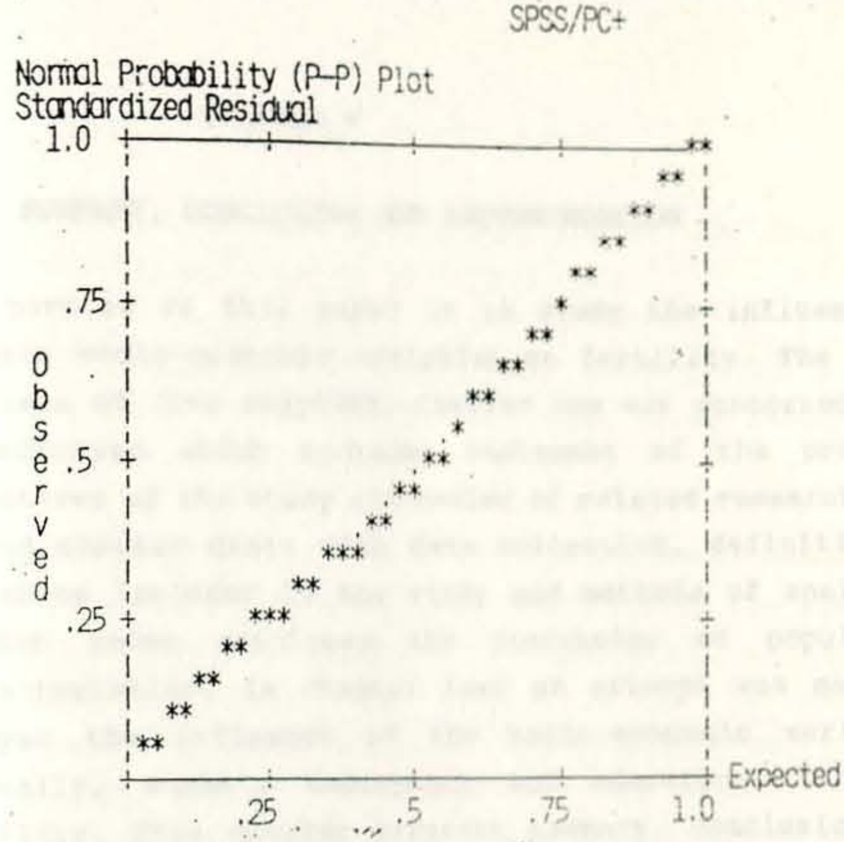
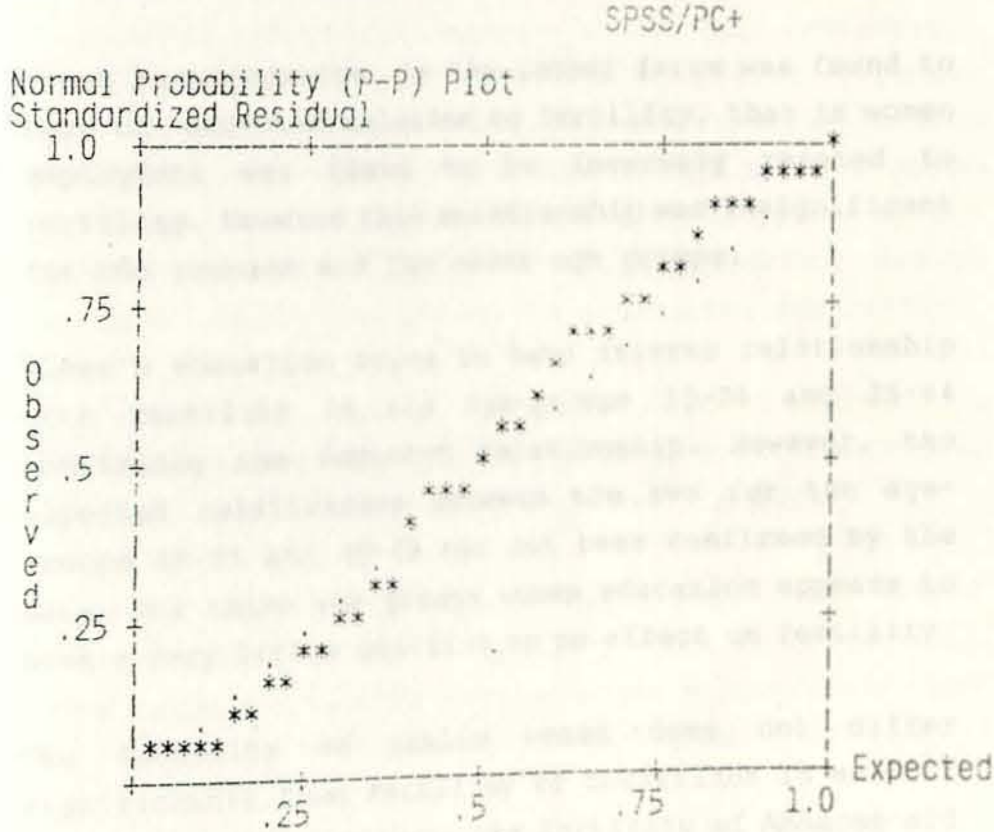

SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
Expected
.25
.5
.75
1.0

FIGURE 15


SPSS/PC+
Normal Probability (P-P) Plot
Standardized Residual
1.0
.75
.5
.25
Observed
Expected
.25
.5
.75
1.0

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

The purpose of this paper is to study the influence of certain socio-economic variables on fertility. The paper consists of five chapters. Chapter one was concerned with introduction which contains statement of the problem, objectives of the study and review of related research. The second chapter dealt with data collection, definition of variables included in the study and methods of analysis. Chapter three continued the discussion of population characteristics. In chapter four an attempt was made to analyse the influence of the socio-economic variables specially, women's employment and education on their fertility. This chapter presents summary, conclusion and recommendation. In what follows an attempt is made to present the findings of this study.

1. Women participation in the labour force was found to have the expected relation to fertility, that is women employment was found to be inversely related to fertility, however this relationship was insignificant for the younger and the older age groups.

2. Women's education seems to have inverse relationship with fertility in the age-groups 15-24 and 35-44 confirming the expected relationship. However, the expected relationship between the two for the age-groups 25-34 and 45-49 has not been confirmed by the data. For these age groups women education appears to have a very little positive or no effect on fertility.

3. The fertility of muslim women does not differ significantly from fertility of christians in each of the age groups. Similarly the fertility of Amharas did not show significant difference from fertility of

women in the other ethnic groups.

4. In each of the age groups income was found to be positively related with fertility.

5. Like women's education the influence of husband's education on fertility was found to be insignificant in certain age groups.

As it has been pointed out above women's education fails to have inverse relationship with fertility in the age groups 25-34 and 45-49. The effect of employment in younger and old age group has been found to be insignificant. Therefore, this study points to the need to improve women's status, particularly education and the participation of women in the labour force by creating job opportunities to woman.

Rapid population growth is deterent to economic development of a country. It affects the standard of living of people in terms of food, education and employment opportunities and facilities for health. The effort and revenue which could have been used to raise the standard of living of the people will be used to provide food, education, health facility and other services to the increasing population.

Rapid population growth brings about environment degradation by exacerbating such problems as deforestation, soil errosion and deterioration of water resources.

Therefore, to tackle problems of rapid population growth effort has to be made in all possible ways to bring about a decline in fertility. The following are suggested as ways by which fertility reduction can be achieved.

1. Providing information about breast feeding

2. providing information about contraceptives and making contraception easier.

3. Creating job opportunities particularly for women.

4. Educating parents.

5. Creating public awareness of the population problem.

6. Raising age at marriage.

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Page 25 SPSS/PC+

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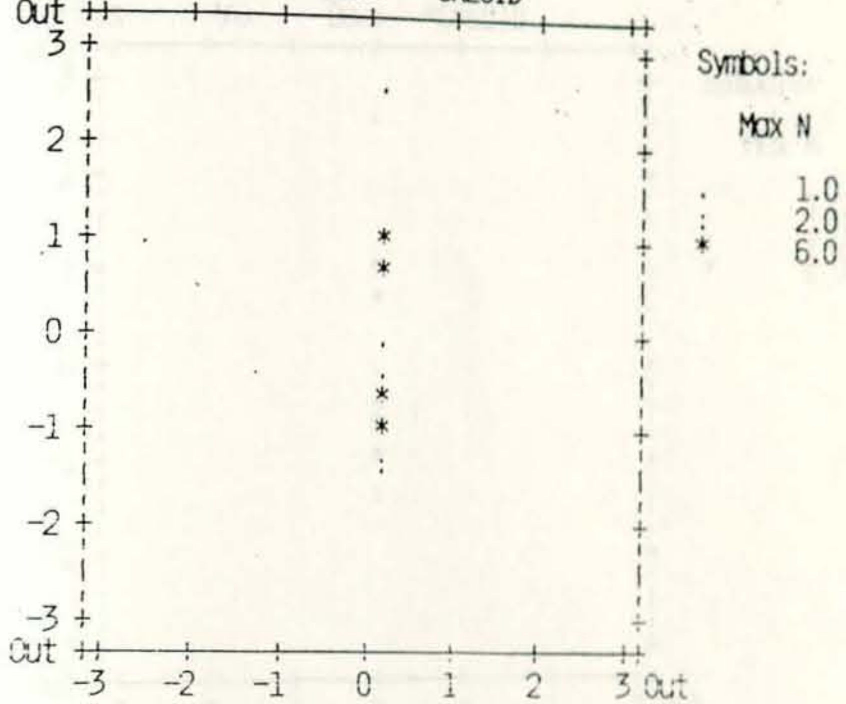

Page 26 SPSS/PC+

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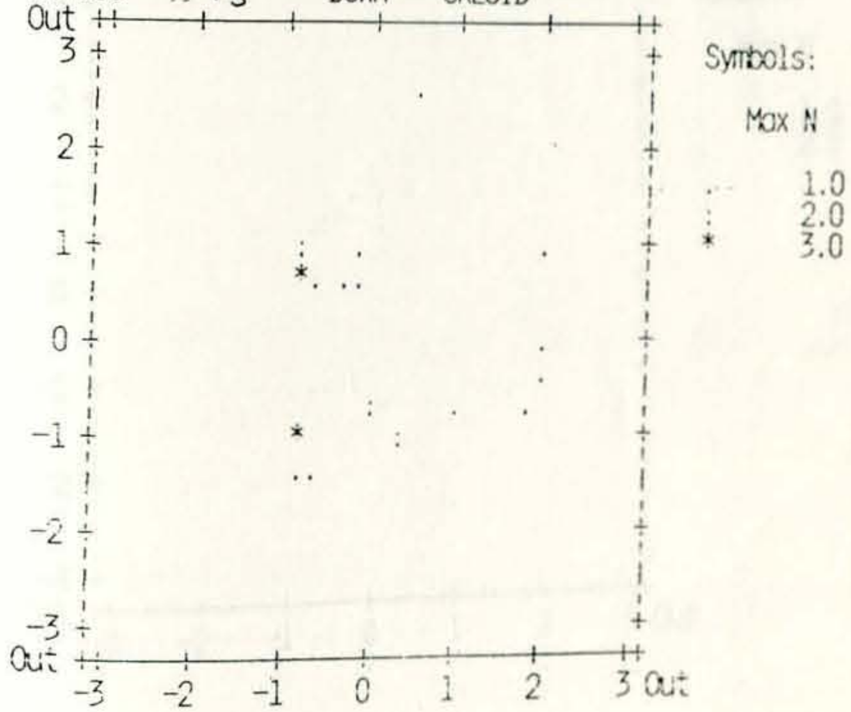

Page 27 SPSS/PC+

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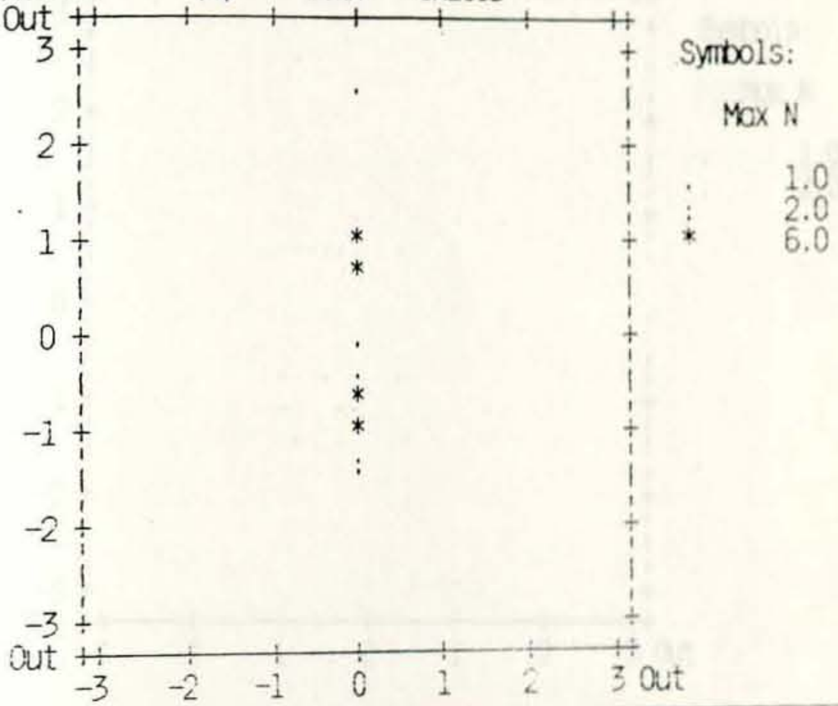

Page 28 SPSS/PC+

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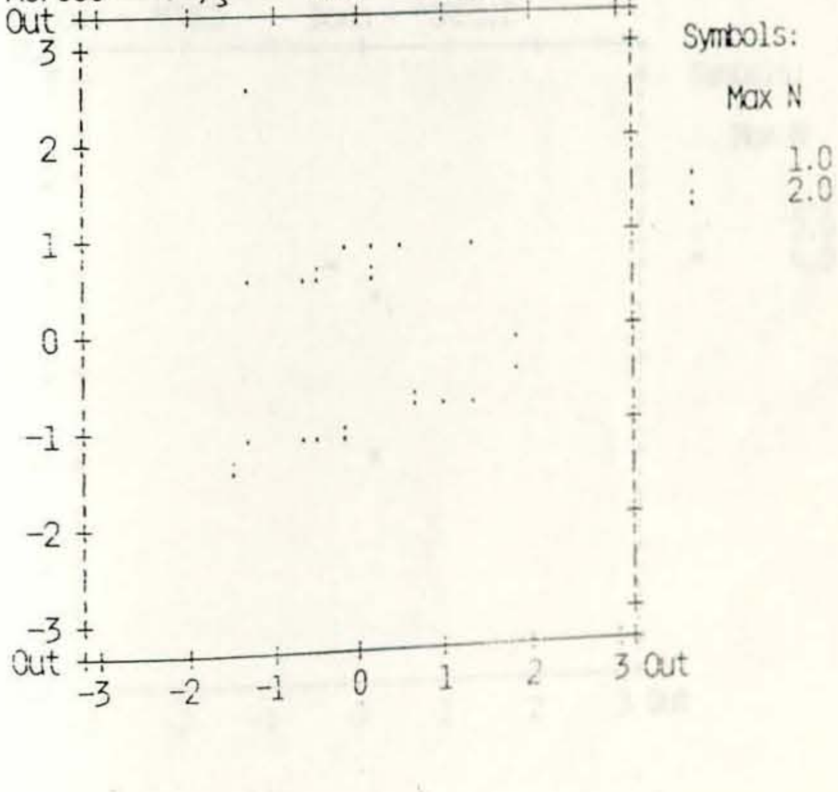

Page 29 SPSS/PC+

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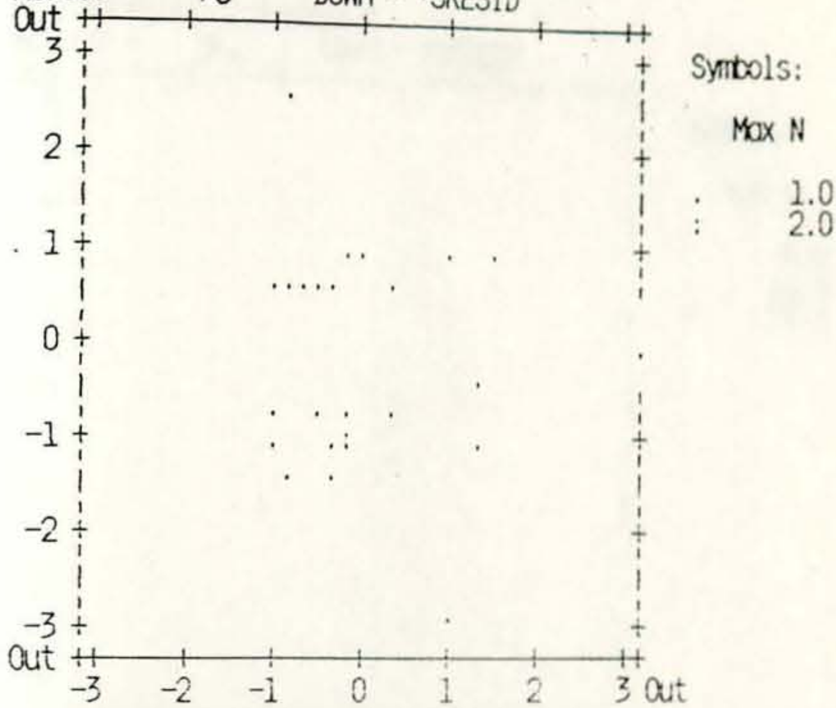

Page 30 SPSS/PC+

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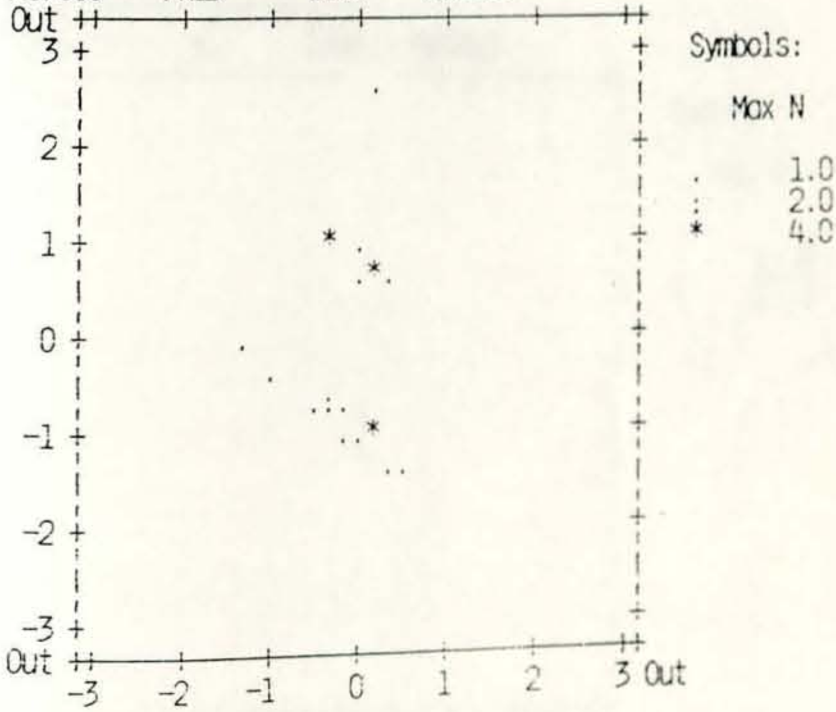

APPENDIX B SCATTER PLOTS: A-G 20-24

Page 38 SPSS/PC+

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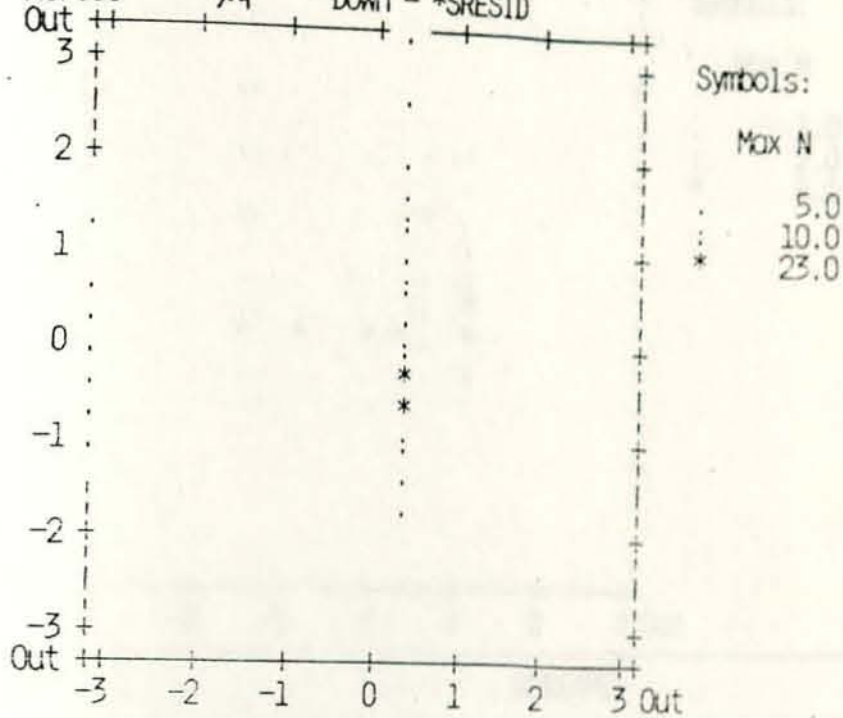

Page 39 SPSS/PC+

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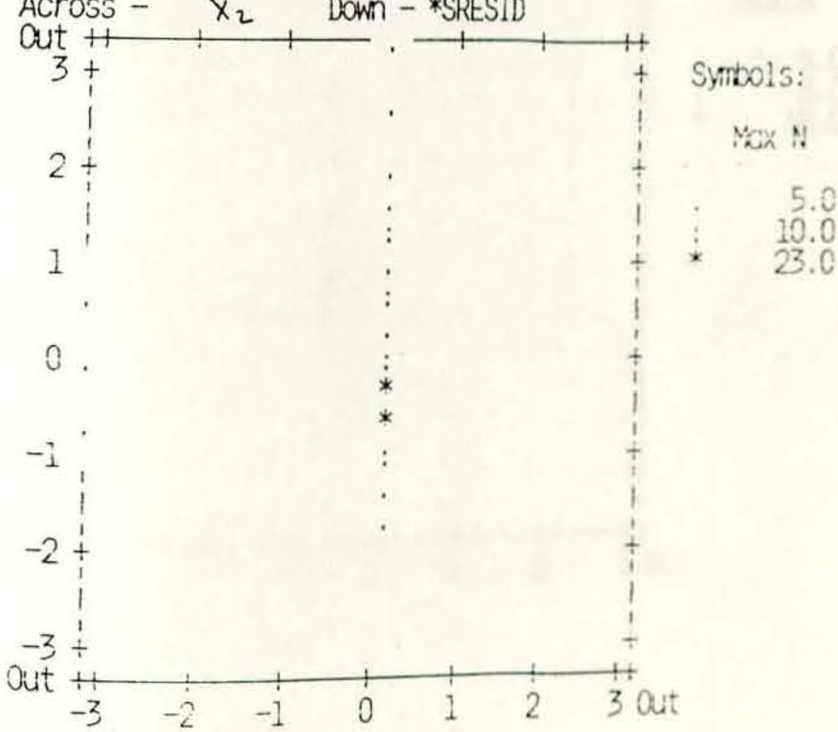
Across - X_2 Down - *SRESID



Page 40 SPSS/PC+

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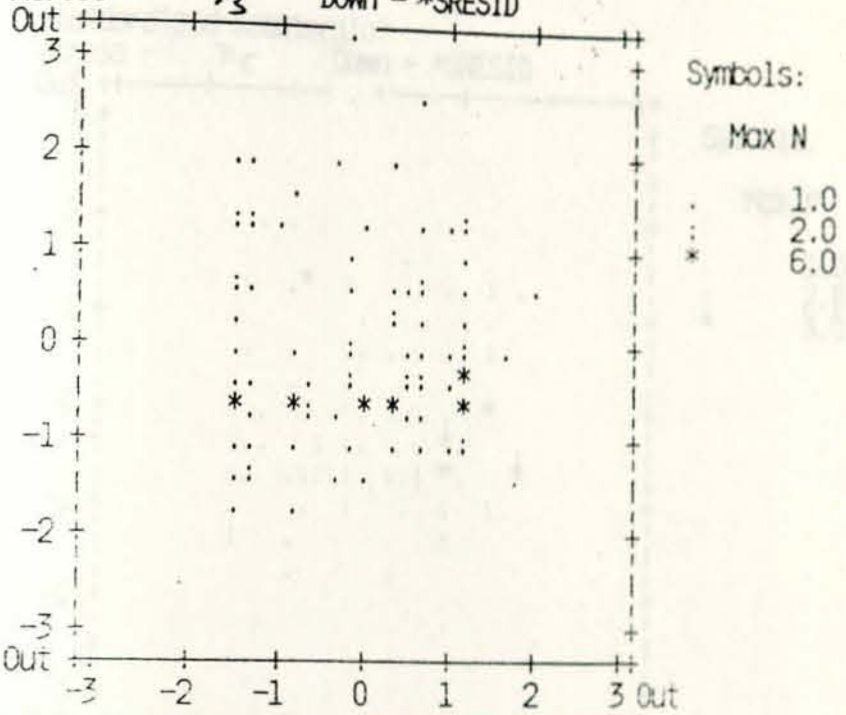
Across - X_3 Down - *SRESID



Page 41 SPSS/PC+

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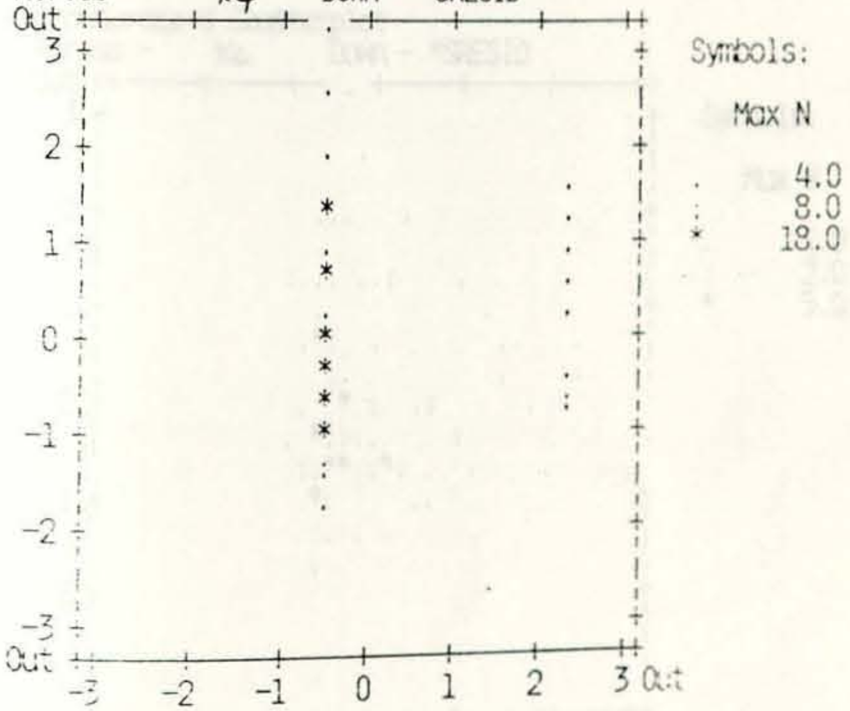
Across - X_4 Down - *SRESID



Page 42 SPSS/PC+

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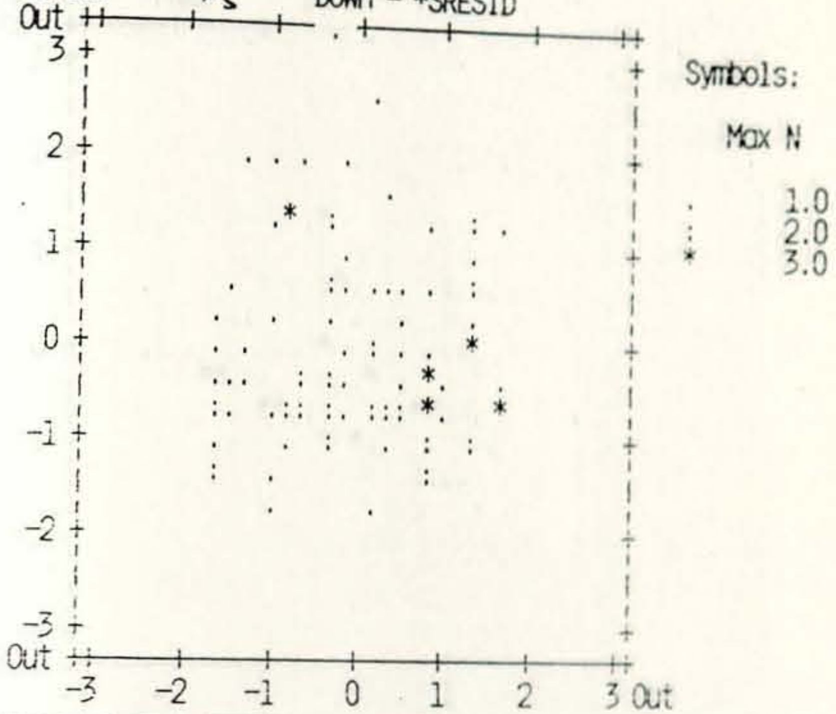
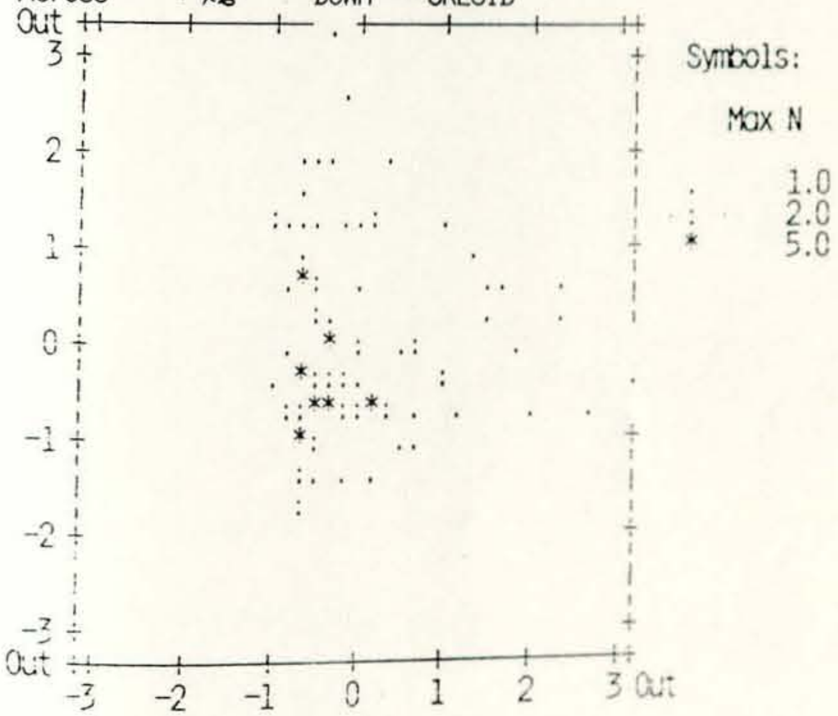


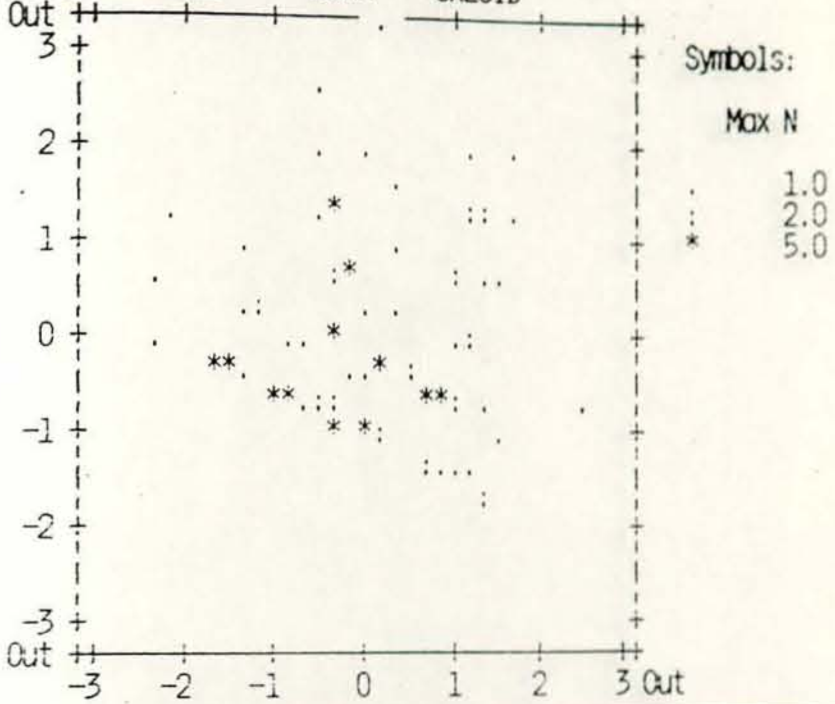
Page 43 SPSS/PC+

Standardized Scatterplot
Across - X_6 Down - *SRESID



Page 44 SPSS/PC+

Standardized Scatterplot
Across - *PRED Down - *SRESID



Page 68 SPSS/PC+

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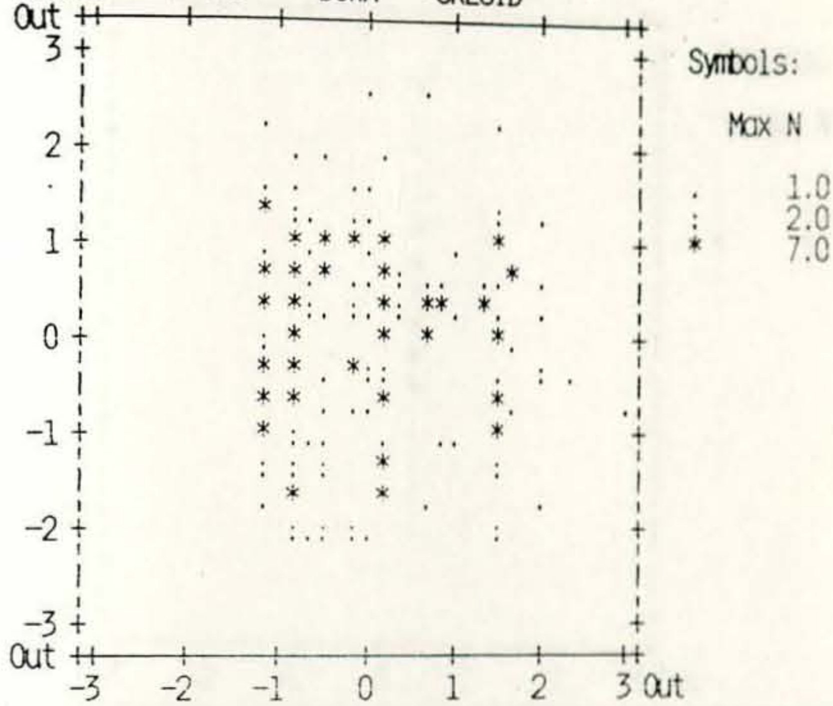

Page 69 SPSS/PC+

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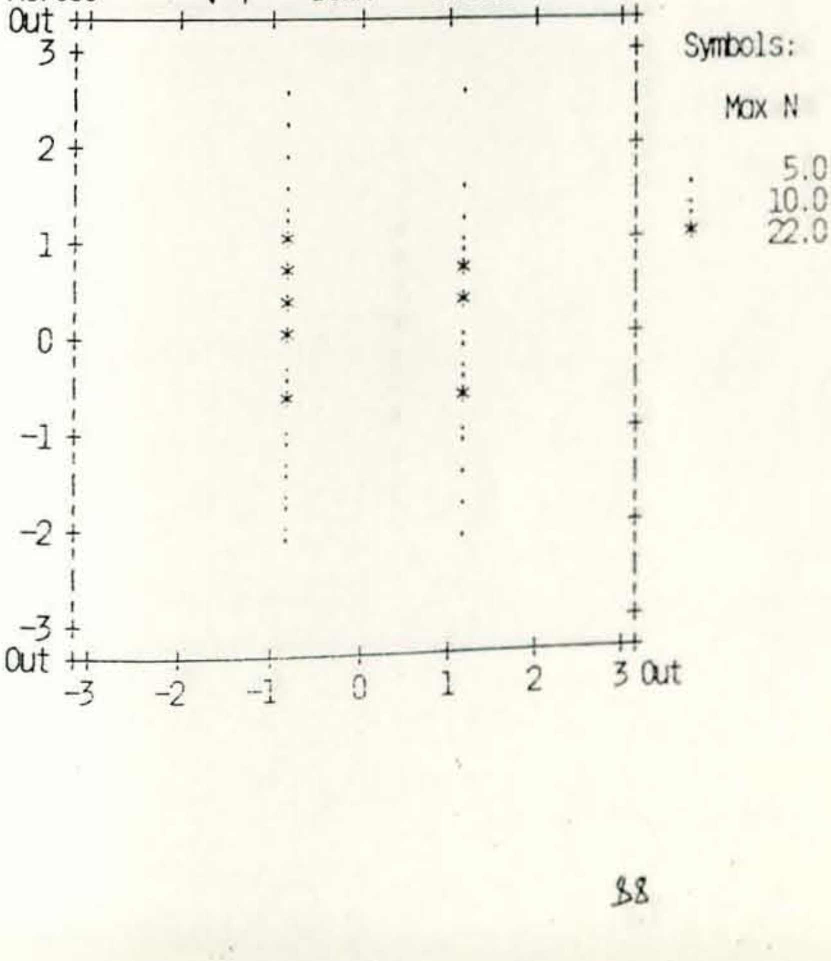

Page 66 SPSS/PC+

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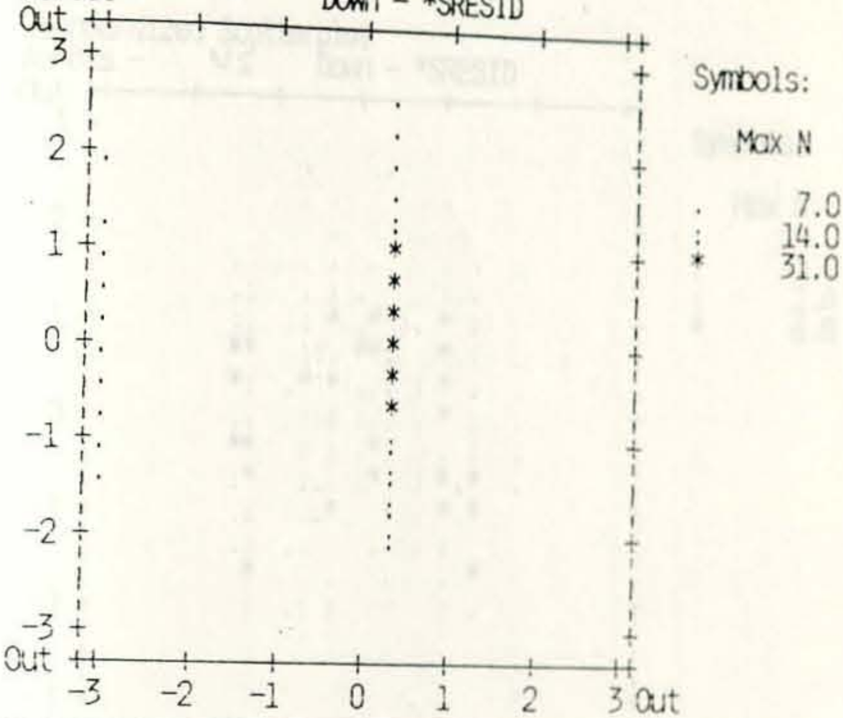

Page 67 SPSS/PC+

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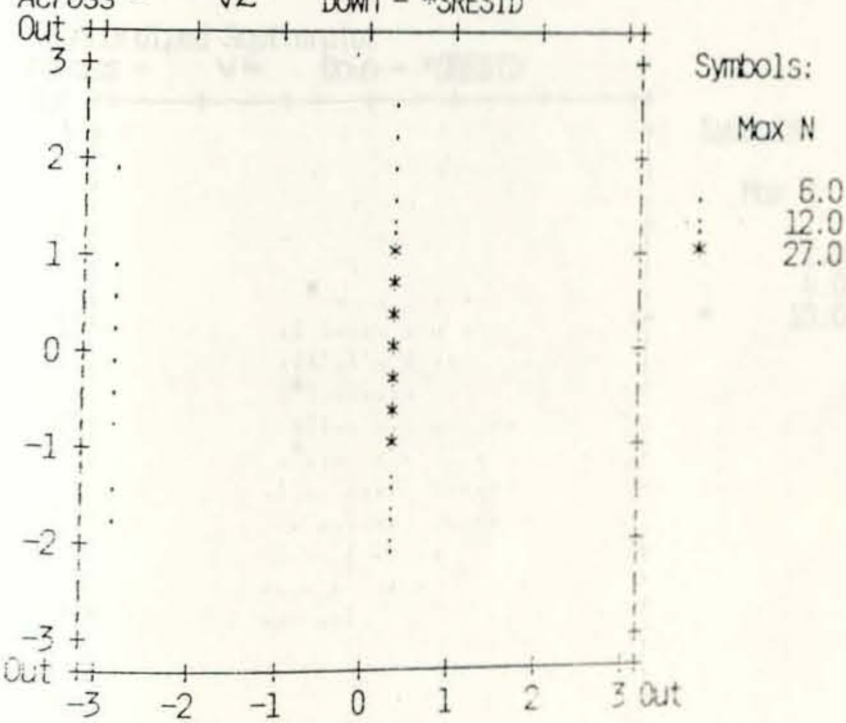

Page 70 SPSS/PC+

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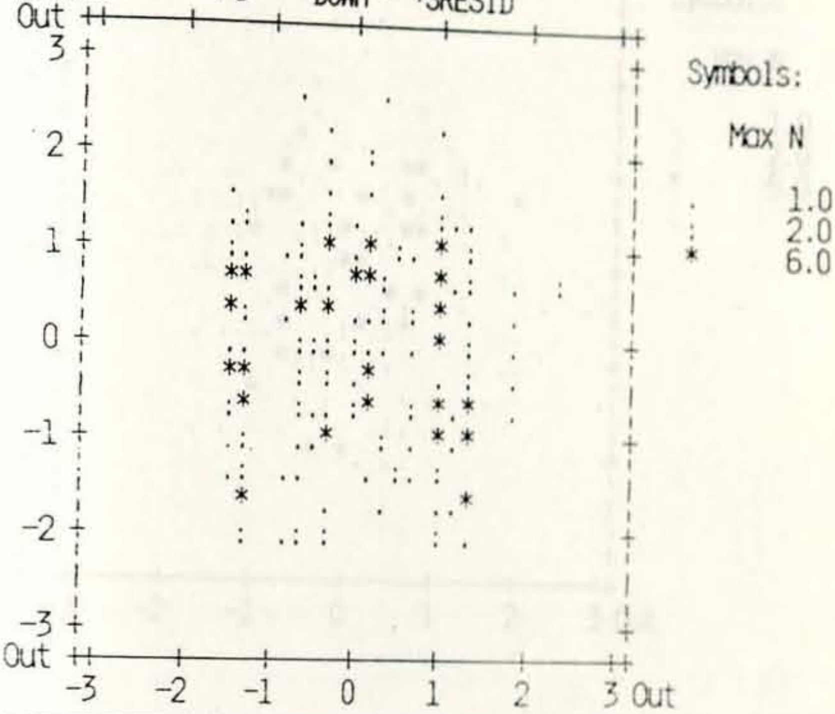
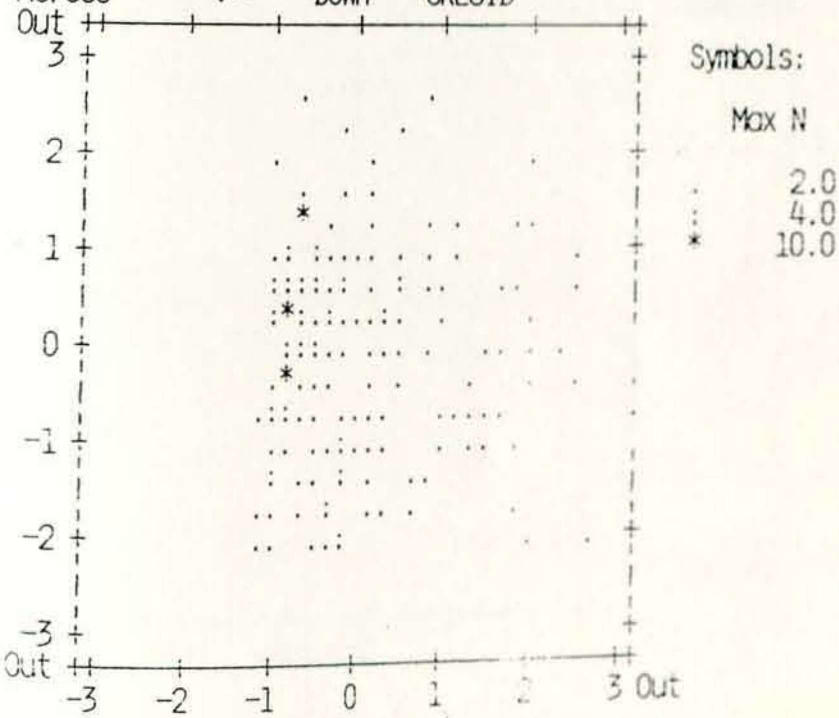


Page 71 SPSS/PC+

Standardized Scatterplot
Across - V6 Down - *SRESID



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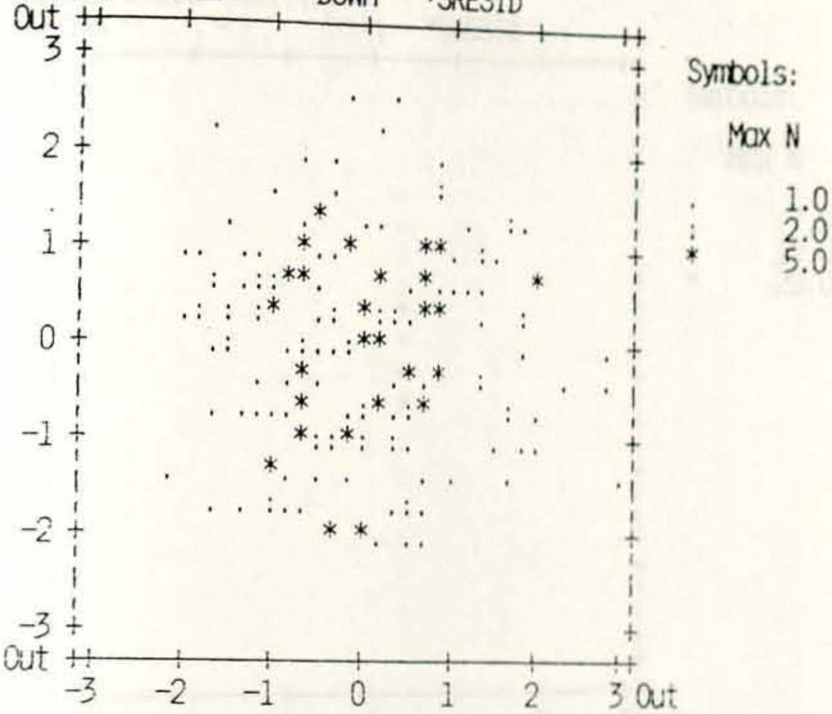
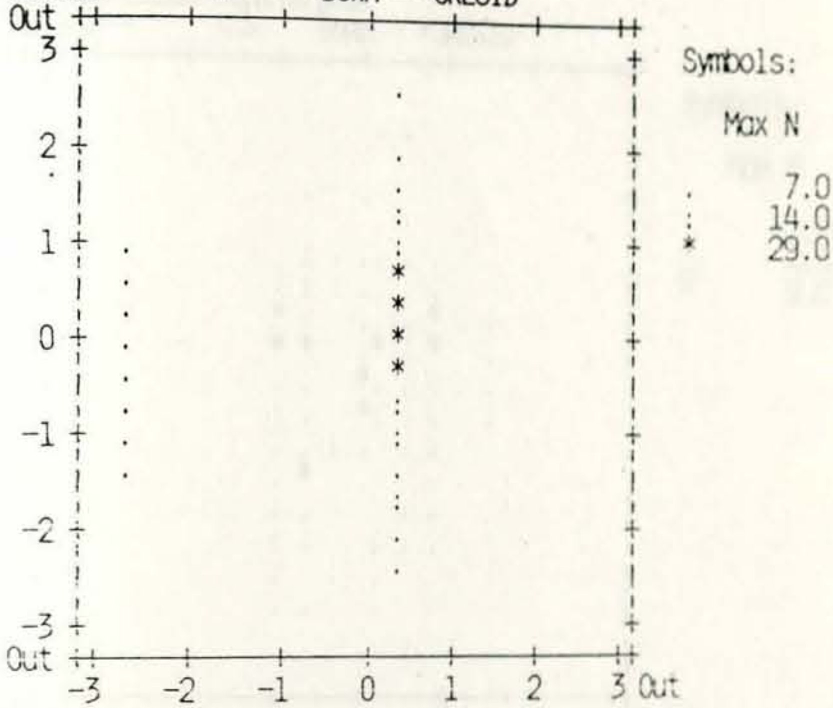


APPENDIX D SCATTER PLOTS: A·G 40-44

Page 21 SPSS/PC+

Standardized Scatterplot
Across - V1 Down - *SRESID



Page 22 SPSS/PC+

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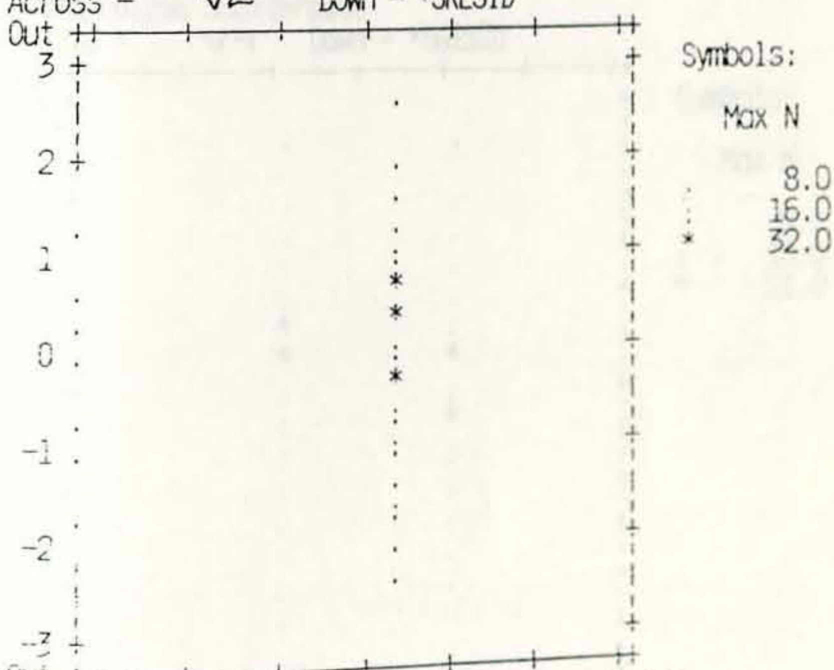
Across - V2 Down - *SRESID



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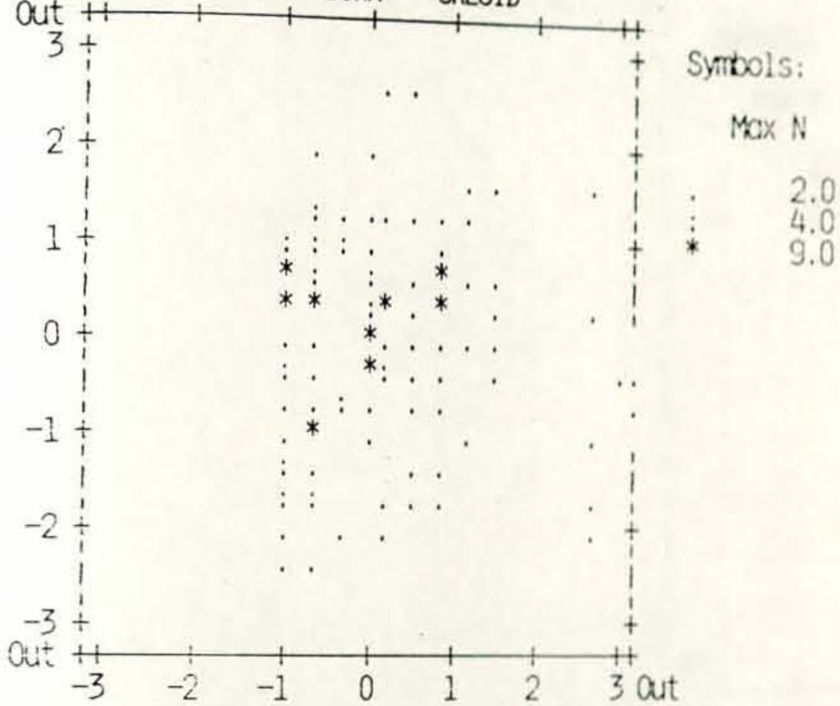

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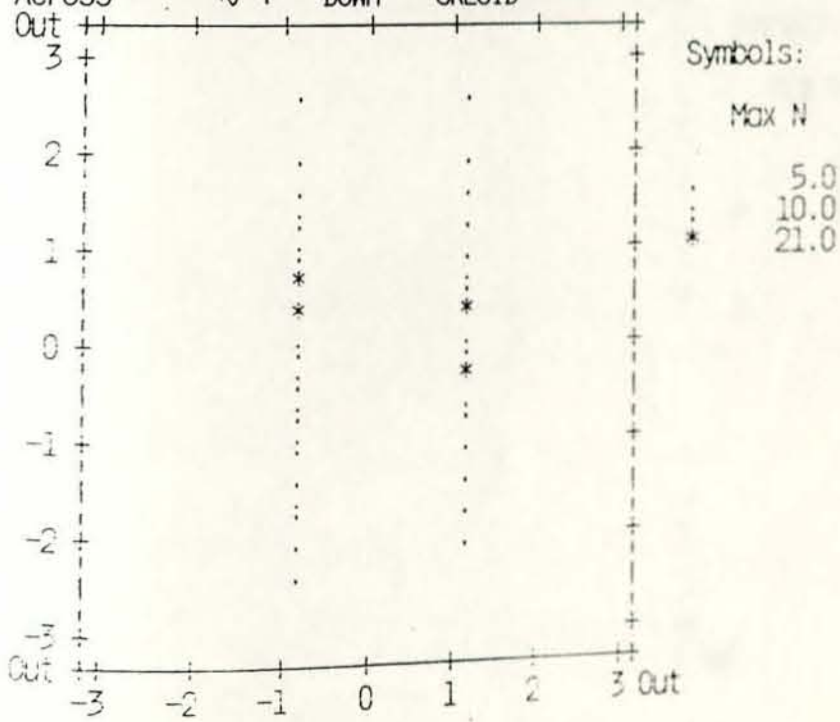

Page 25 SPSS/PC+

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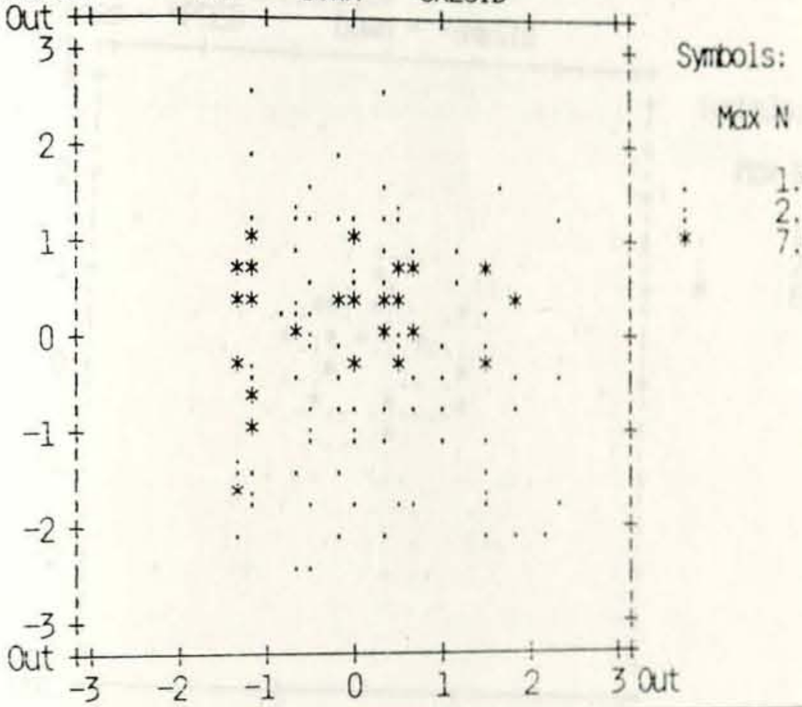
Across - V5 Down - *SRESID



Page 26 SPSS/PC+

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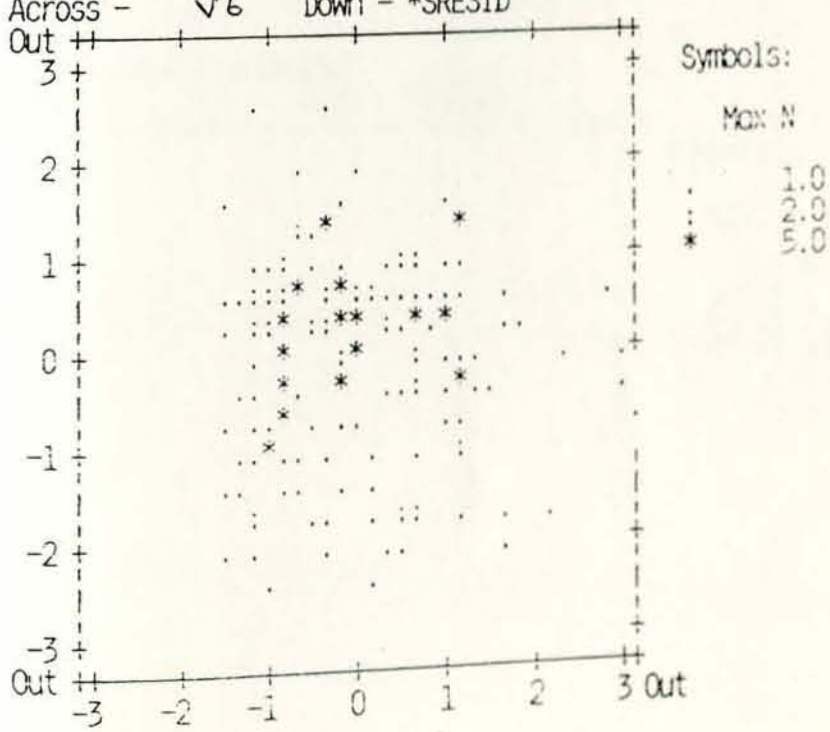
Across - V6 Down - *SRESID



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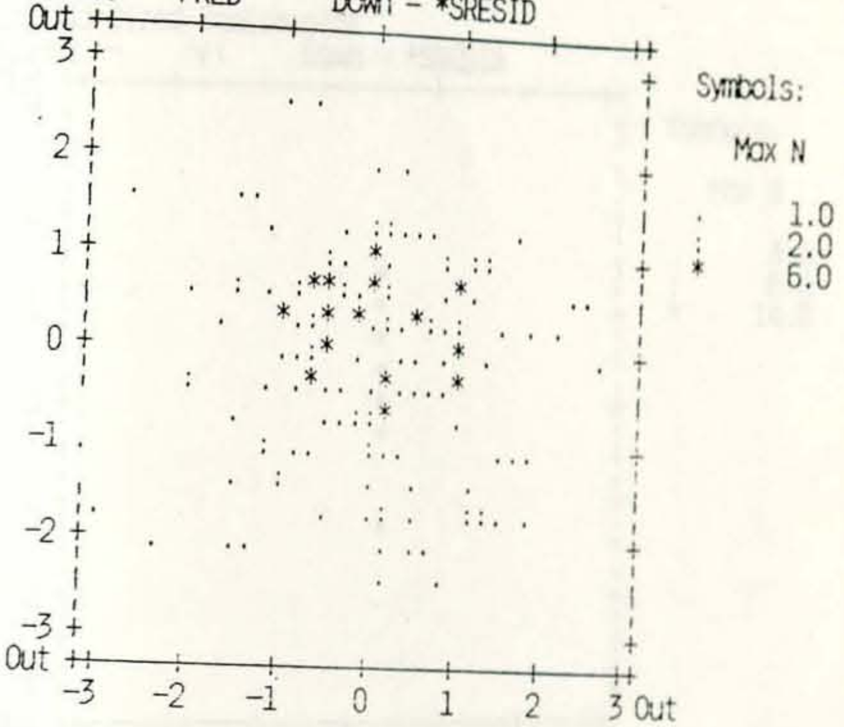

APPENDIX E SCATTER PLOTS: A.G 45-49

Page 35 SPSS/PC+

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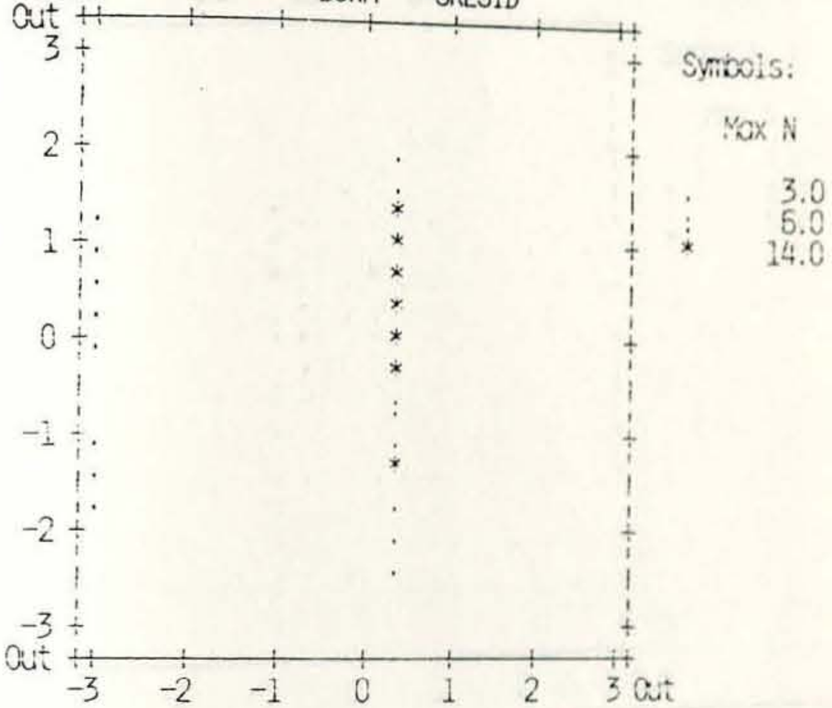
Across - V1 Down - *SRESID



Page 36 SPSS/PC+

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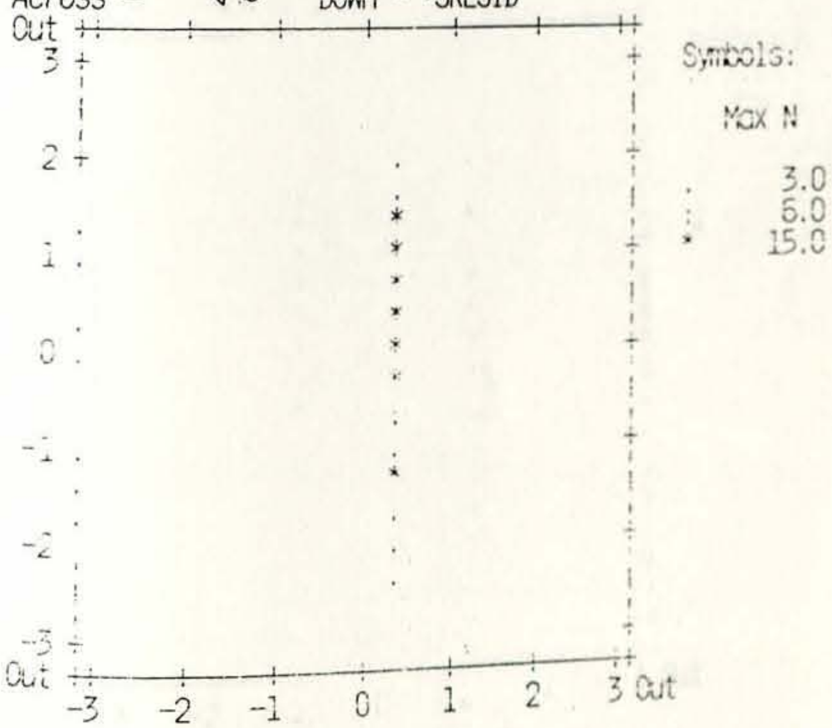
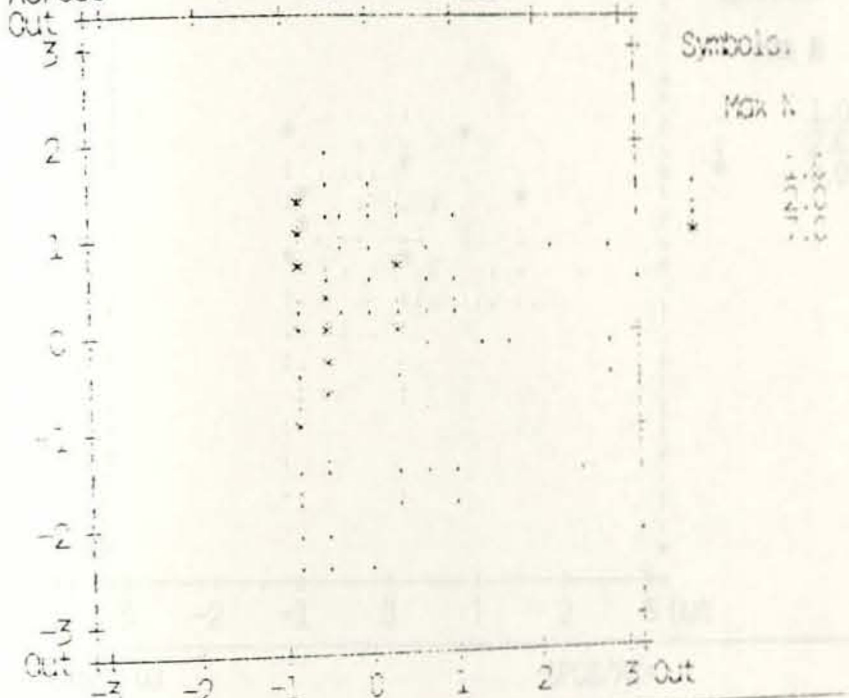
Across - V2 Down - *SRESID



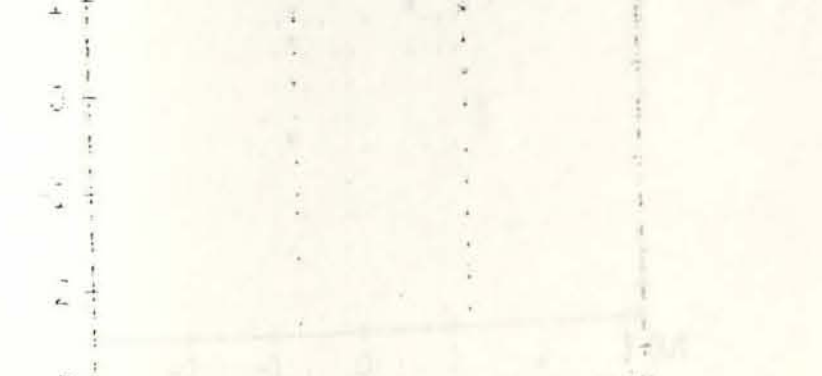
Page 37 SPSS/PC+

Standardized Scatterplot
Across - V3 Down - *SRESID



Page 38 SPSS/PC+

Standardized Scatterplot
Across - V4 Down - *SRESID



Page 39 SPSS/PC+

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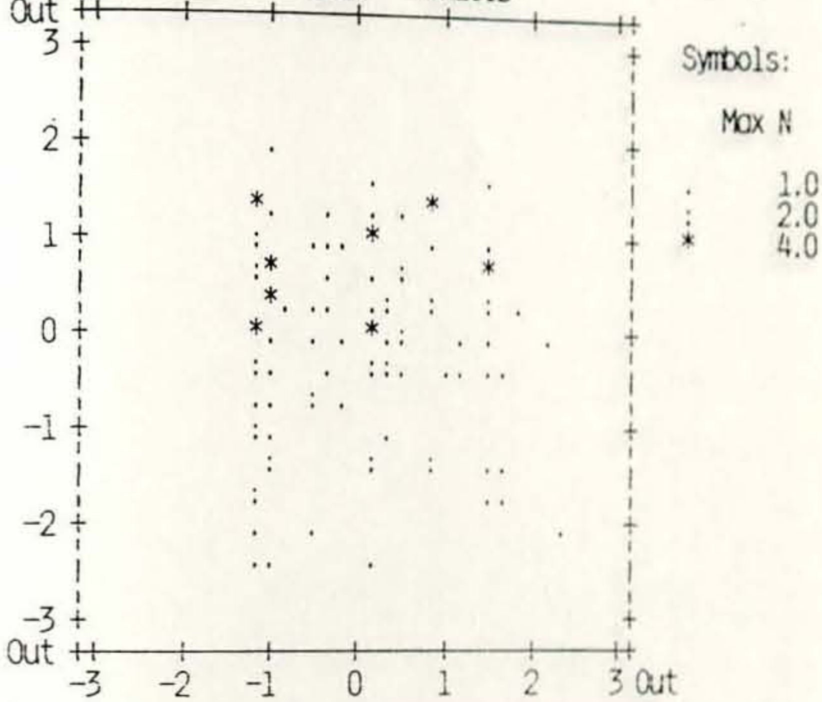
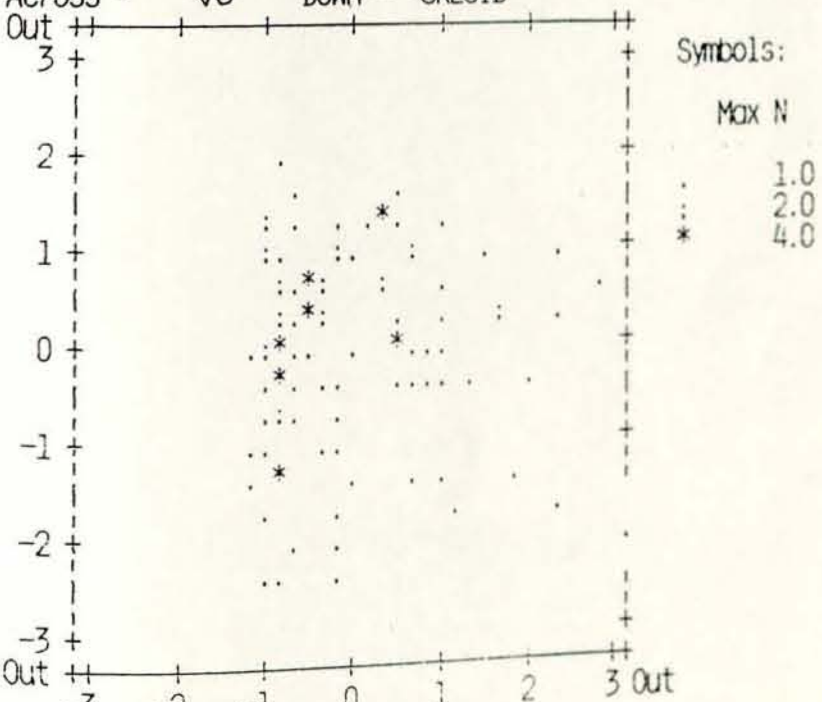
Across - V5 Down - *SRESID



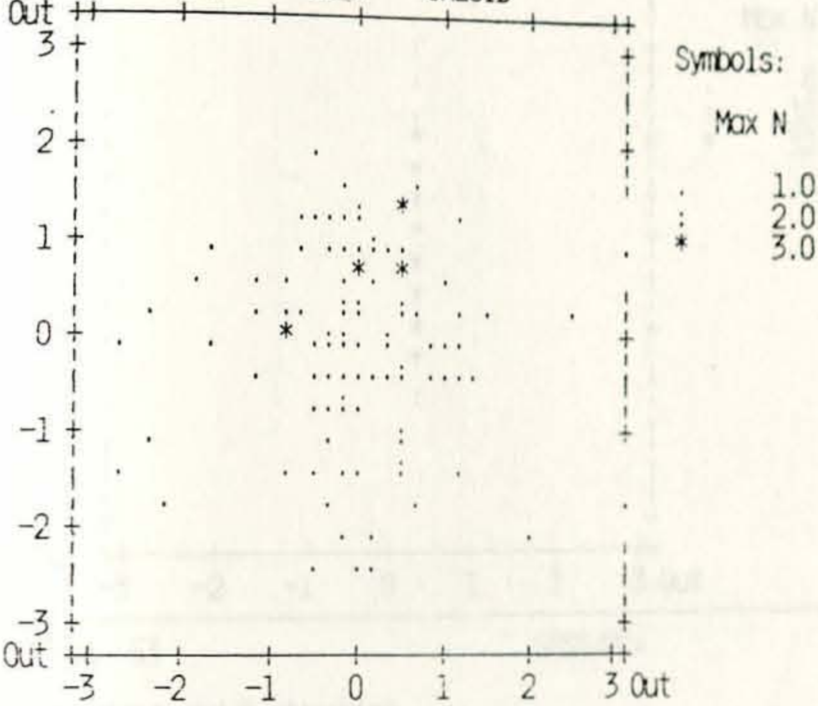
Page 40 SPSS/PC+

Standardized Scatterplot
Across - V6 Down - *SRESID



Page 41 SPSS/PC+

Standardized Scatterplot
Across - *PRED Down - *SRESID



APPENDIX F SCATTER PLOTS: A.G. 25-28

Page 52 SPSS/PC+

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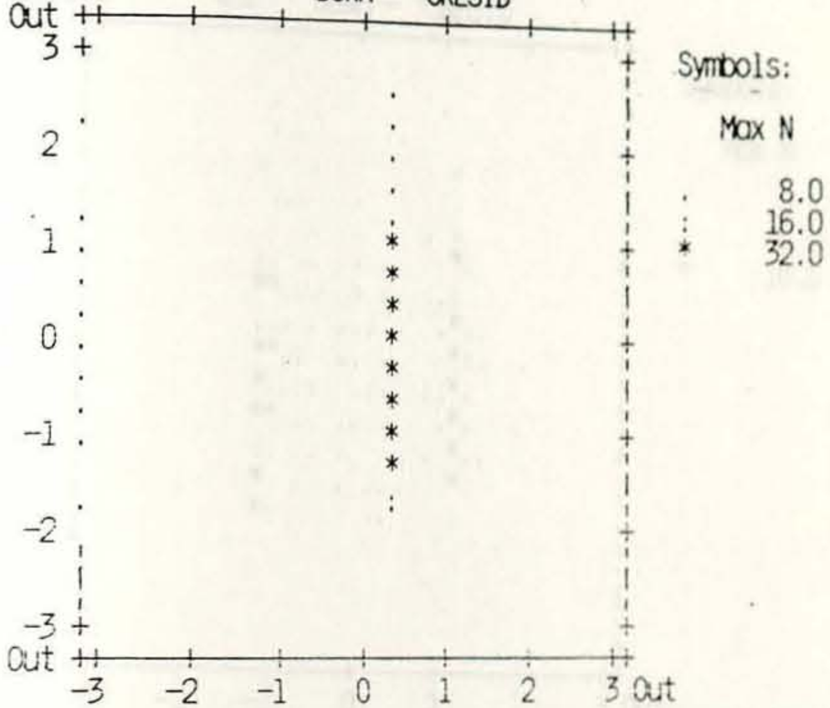
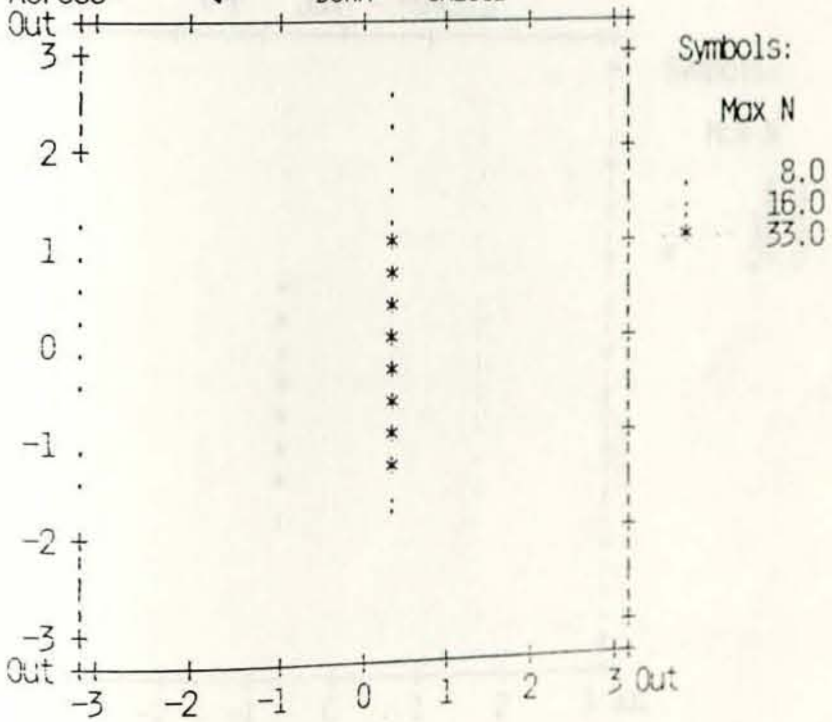


Page 53 SPSS/PC+

Standardized Scatterplot
Across - V2 Down - *SRESID



Page 54 SPSS/PC+

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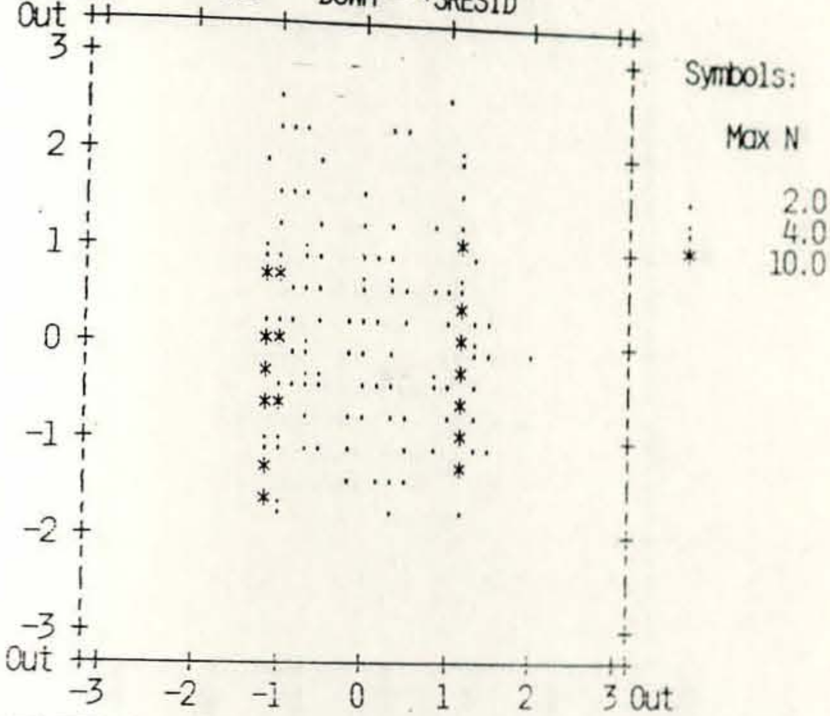

Page 55 SPSS/PC+

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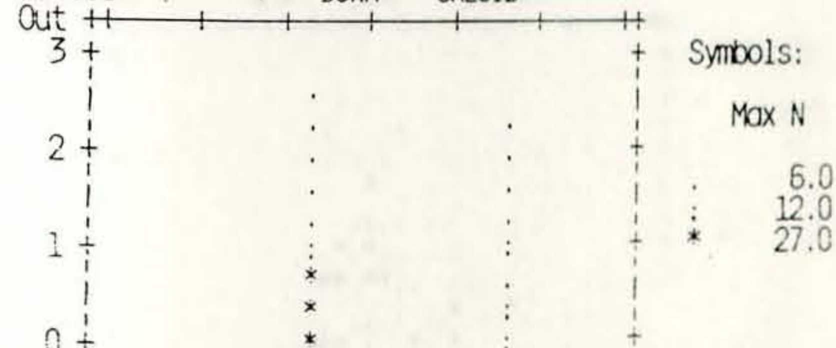
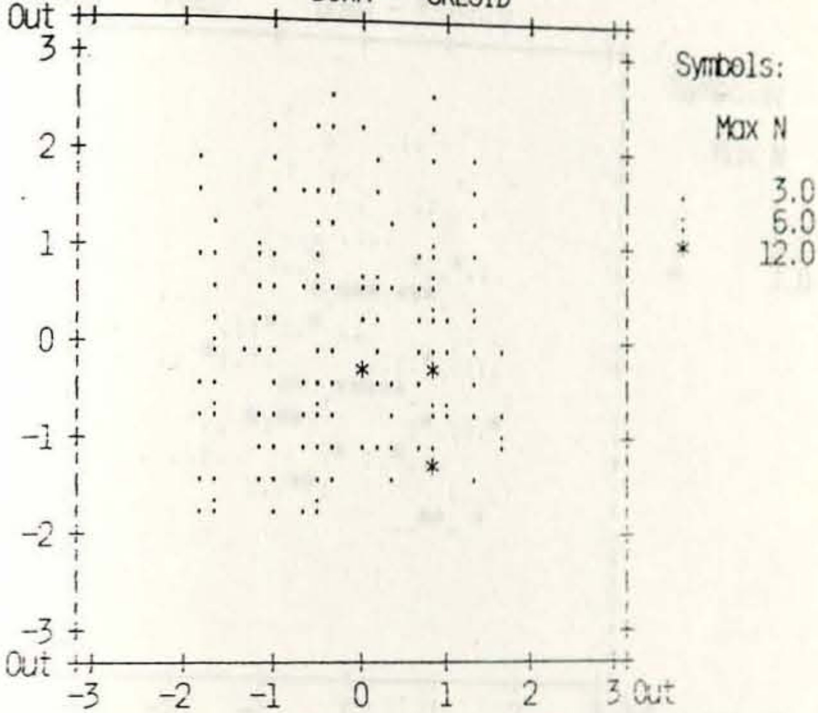
Across - V4 Down - *SRESID



Page 56 SPSS/PC+

Standardized Scatterplot
Across - V5 Down - *SRESID



Page 57 SPSS/PC+

Standardized Scatterplot
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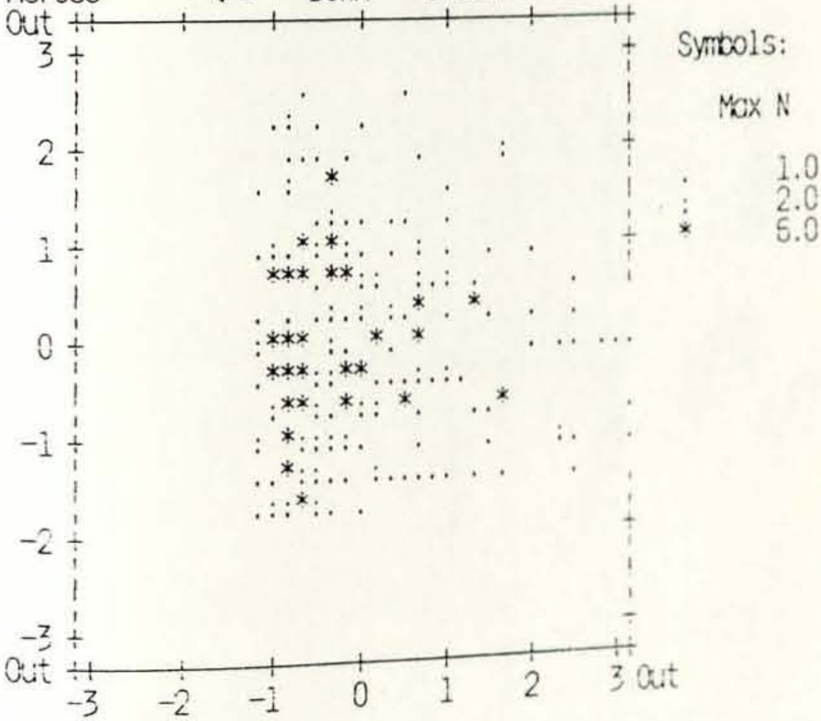

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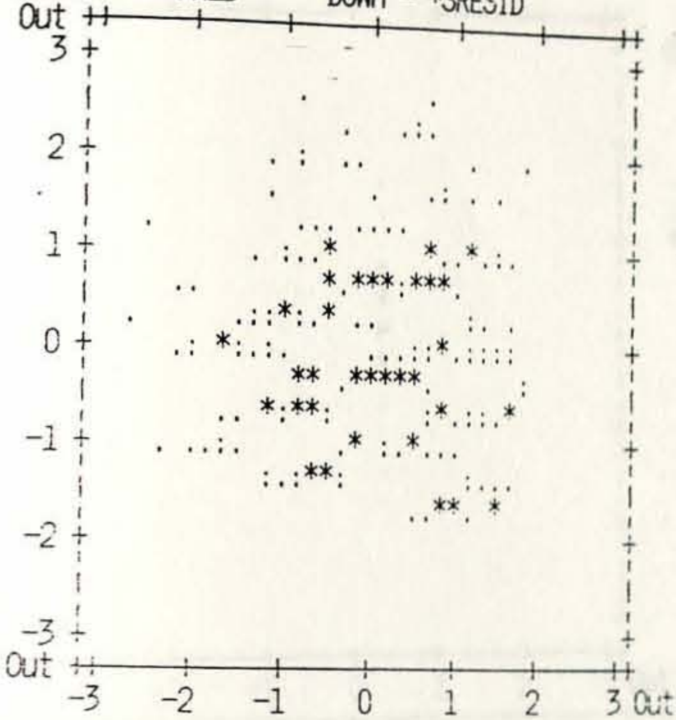

Symbols:

Max N

. 1.0
: 2.0
* 7.0

ATTACHMENT G SCATTE PLOTS: A.G 35-39

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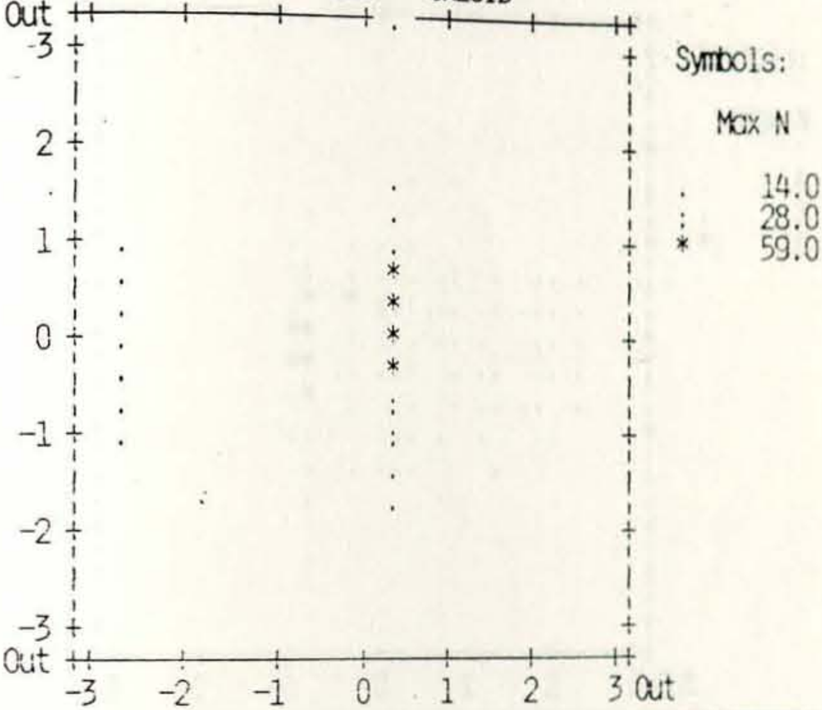
Across - V1 Down - *SRESID



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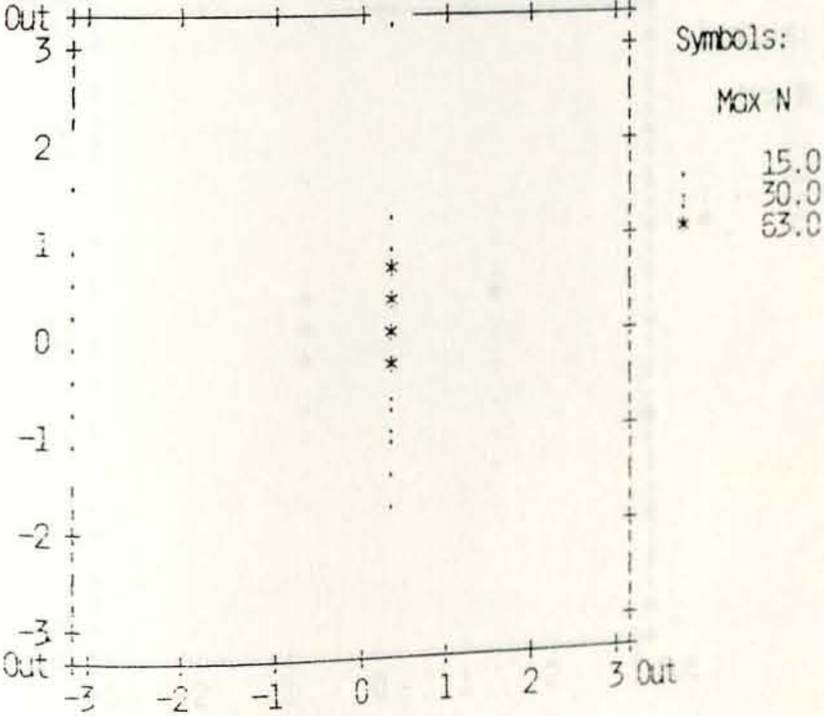

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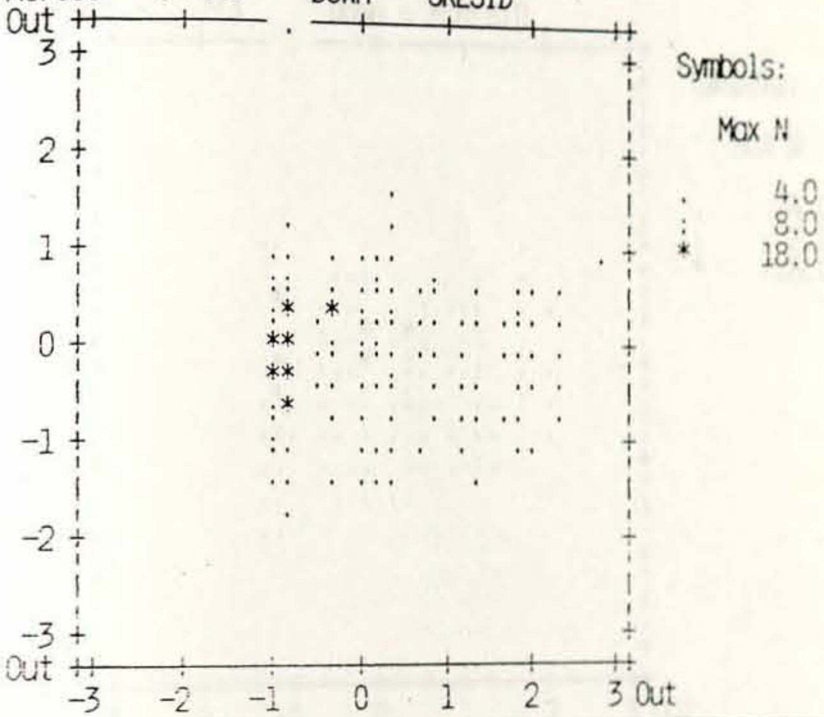
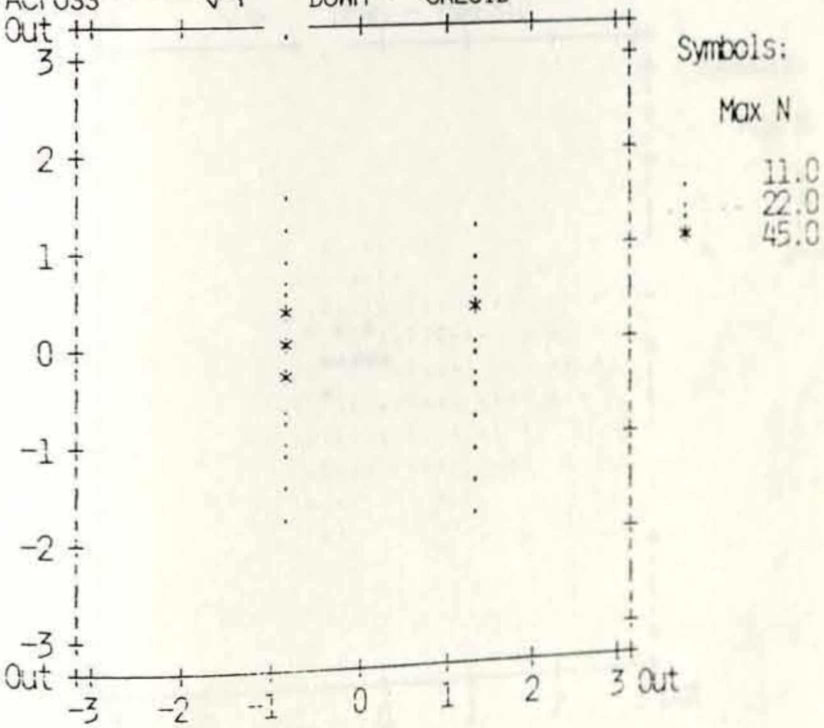


Standardized Scatterplot
Across - V4 Down - *SRESID



Page 11 SPSS/PC+

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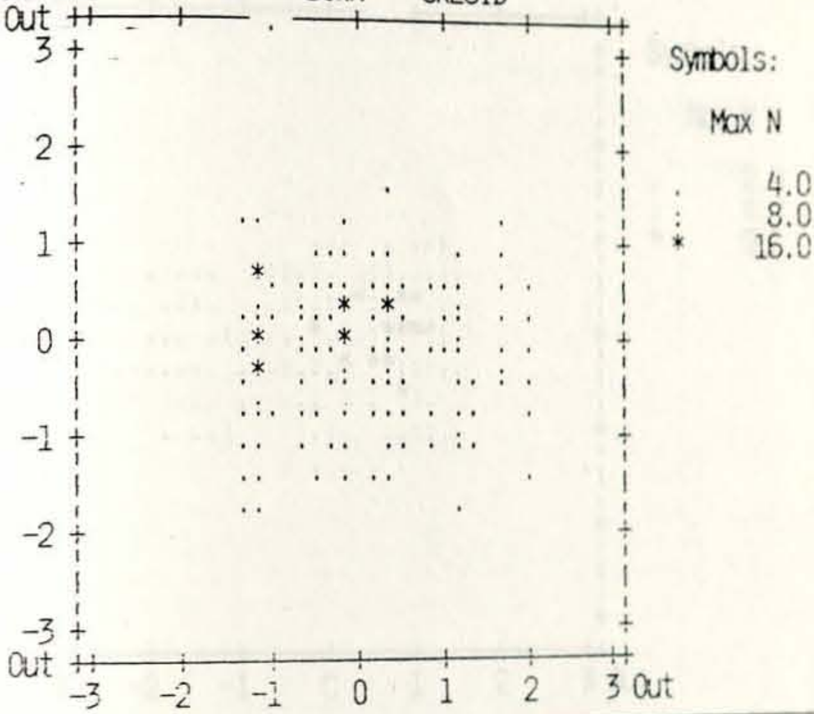
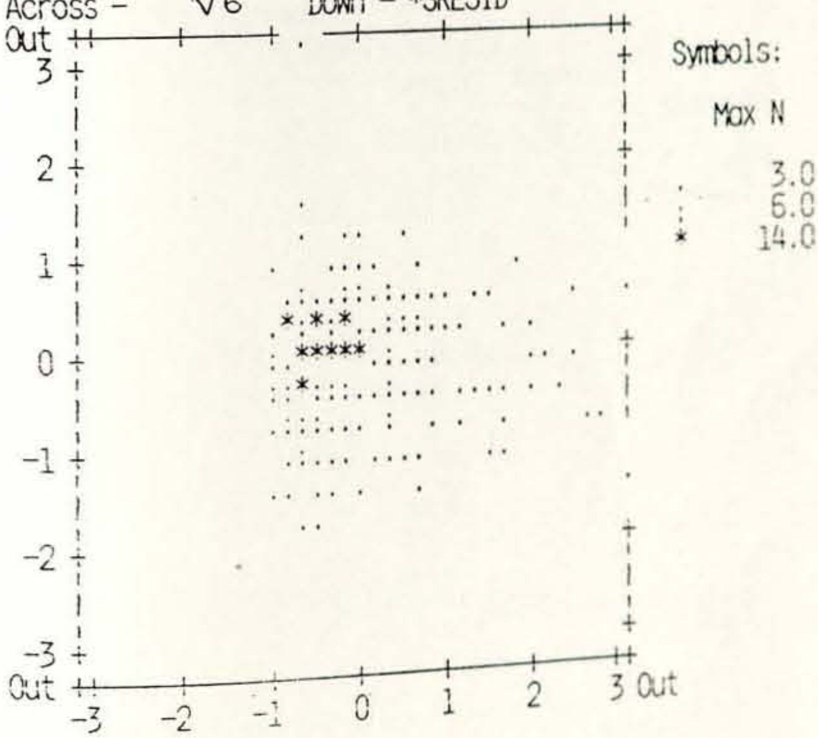


Page 12 SPSS/PC+

Standardized Scatterplot
Across - V6 Down - *SRESID



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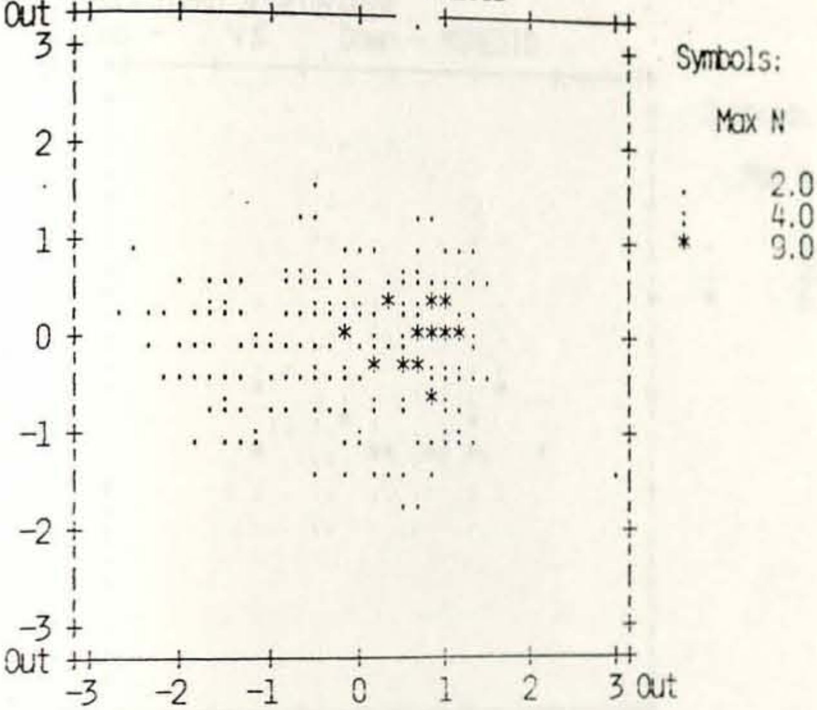

Page 22 SPSS/PC+

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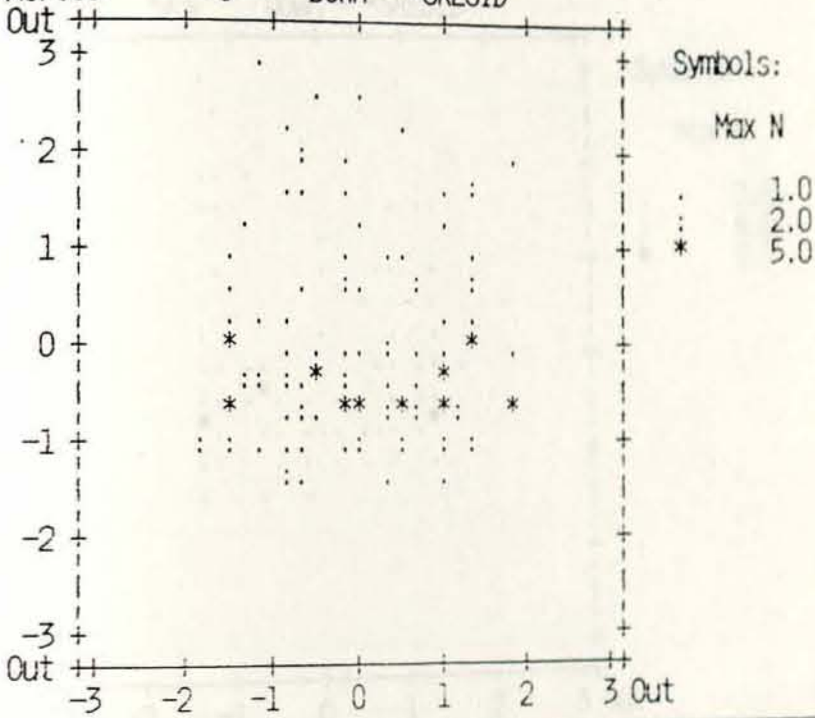

Page 23 SPSS/PC+

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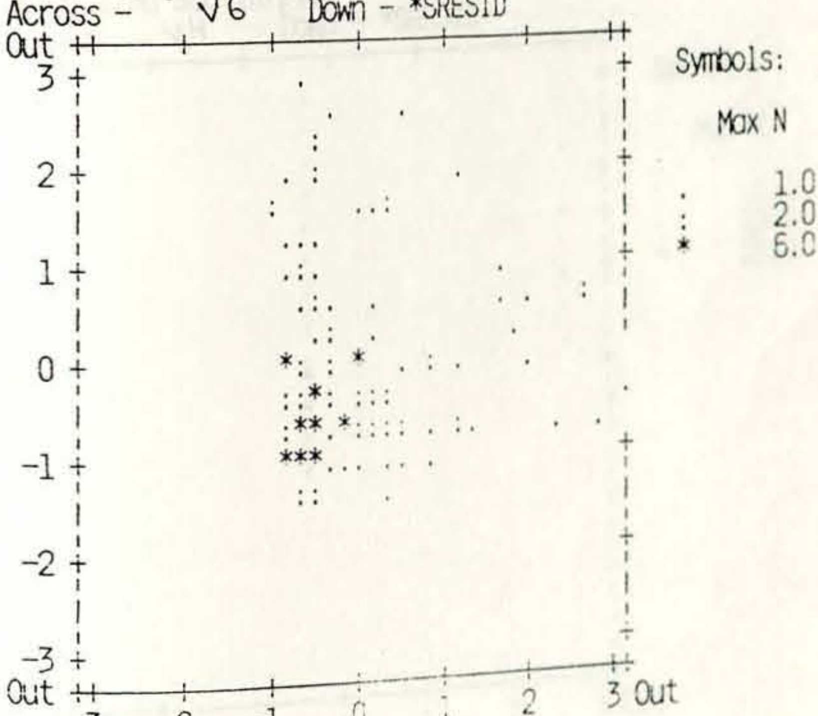

Page 20 SPSS/PC+

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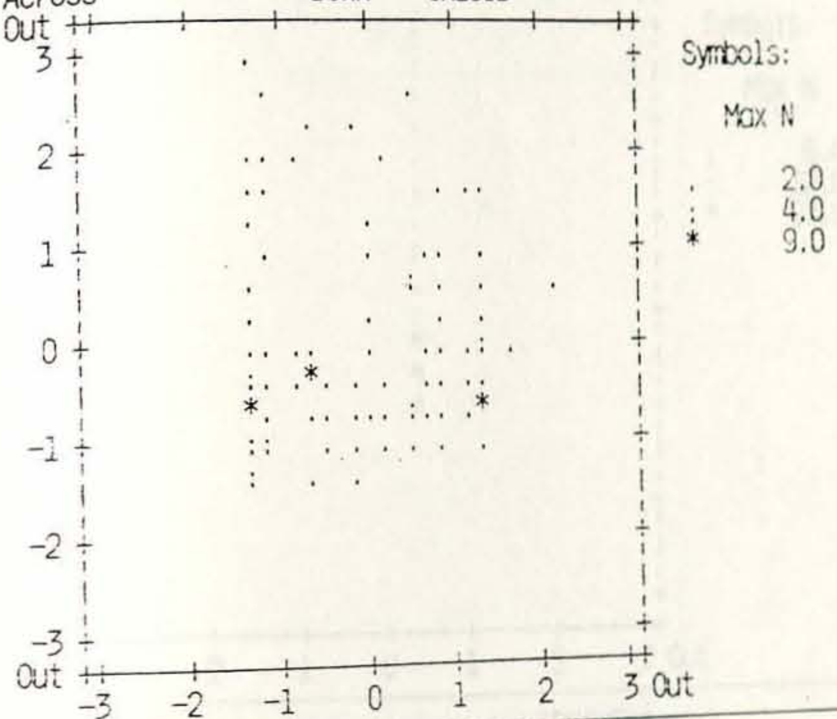

Page 21 SPSS/PC+

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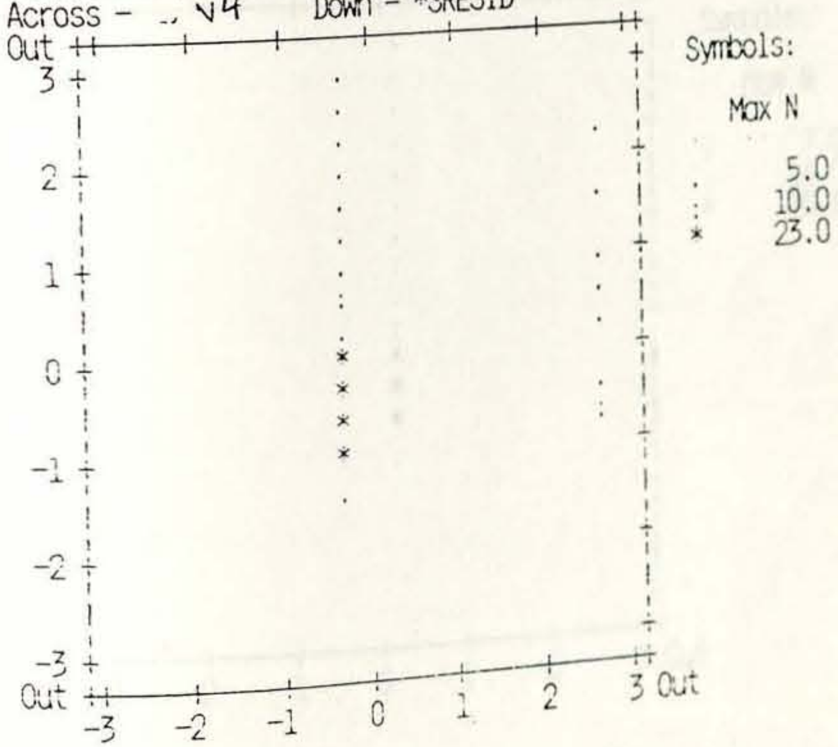

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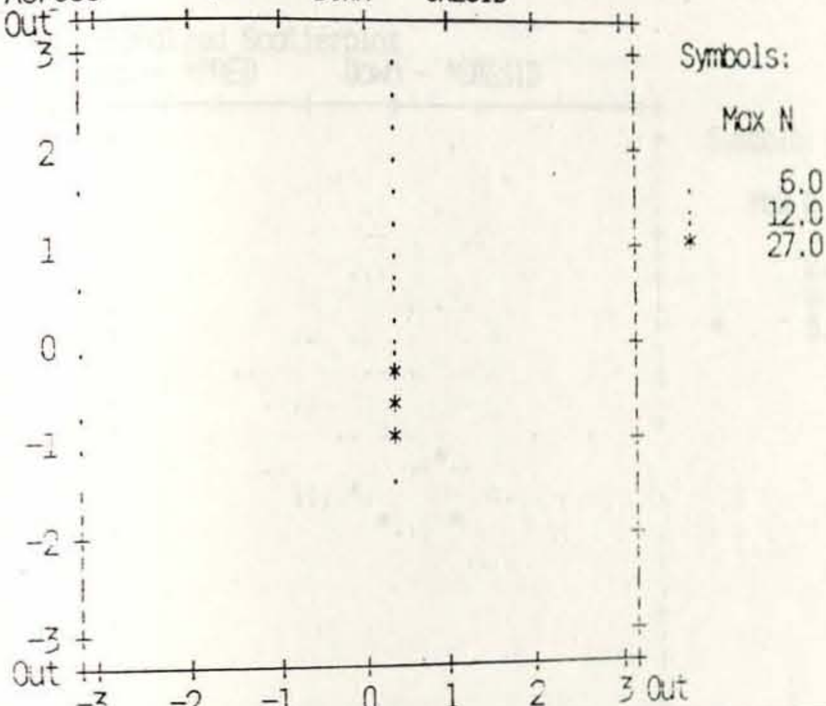

Standardized Scatterplot
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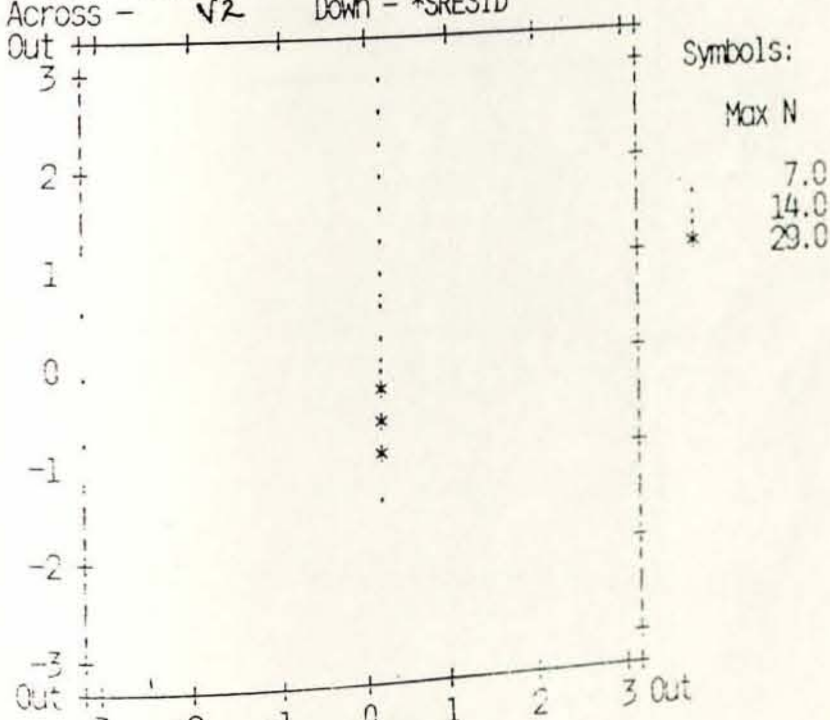
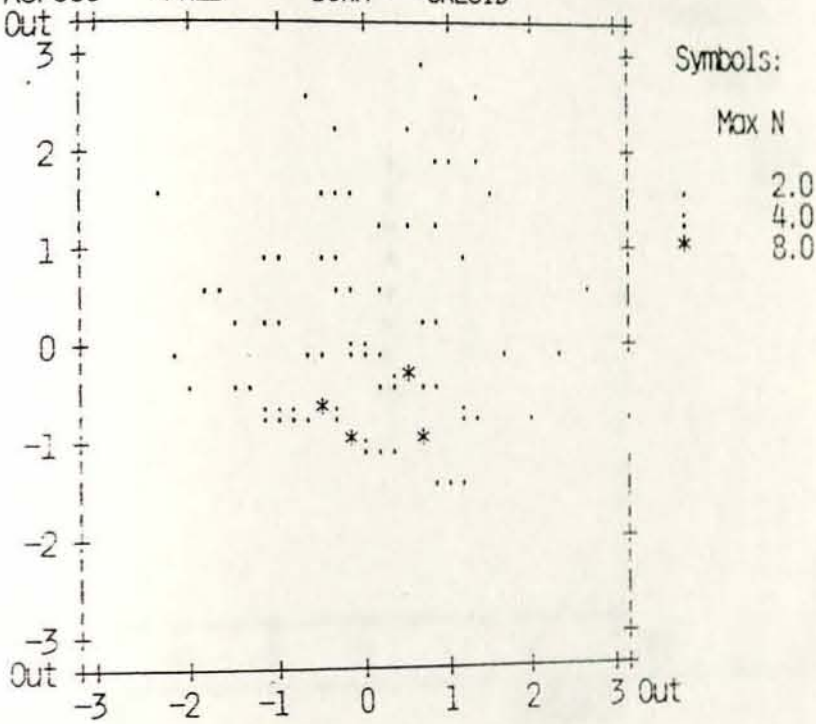
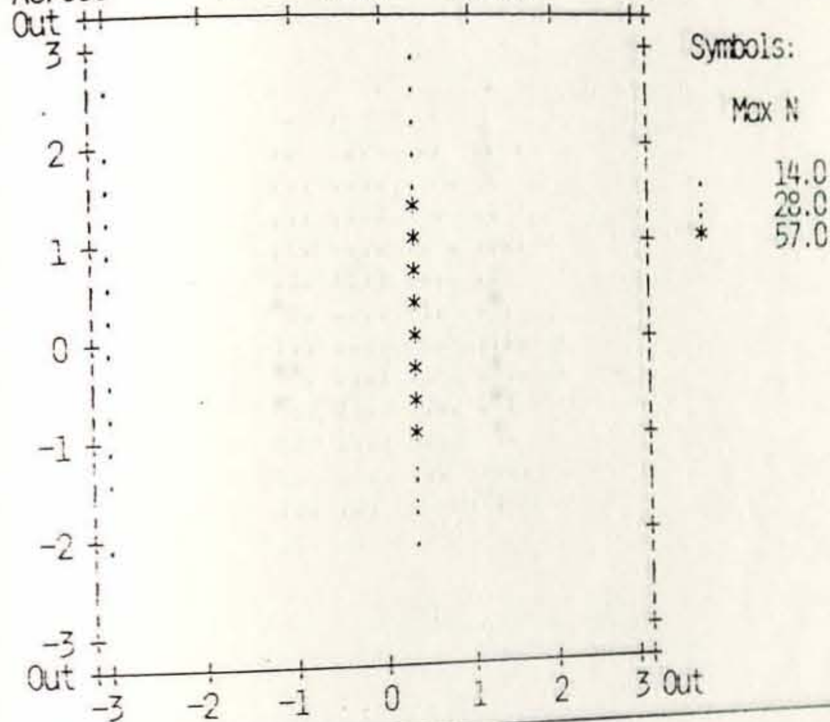


Standardized Scatterplot
Across - *PRED Down - *SRESID



Page 32 SPSS/PC+

Standardized Scatterplot
Across - V1 Down - *SRESID



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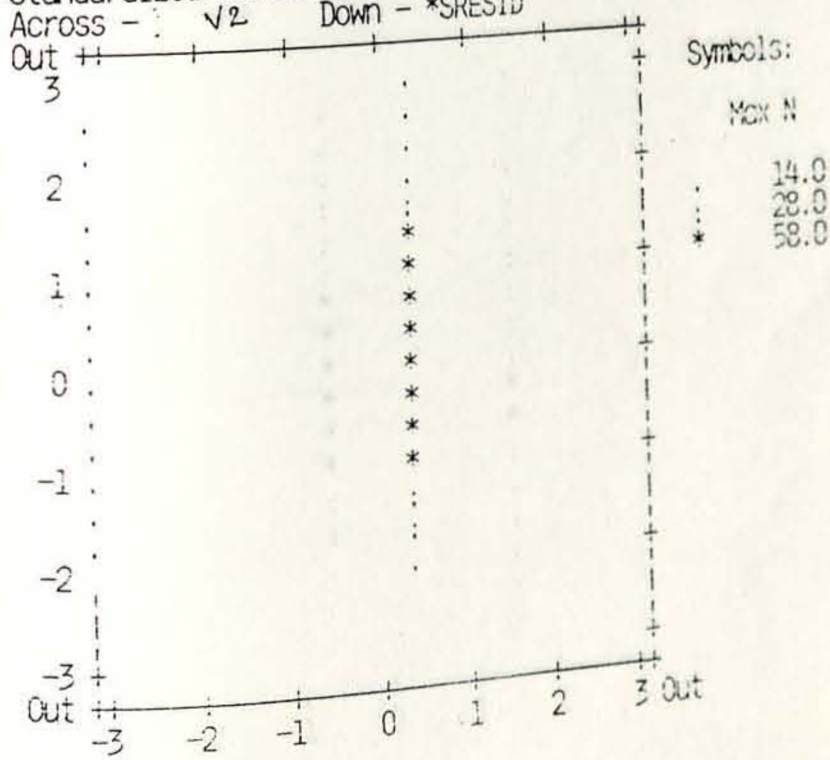
Across - V2 Down - *SRESID



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Standardized Scatterplot
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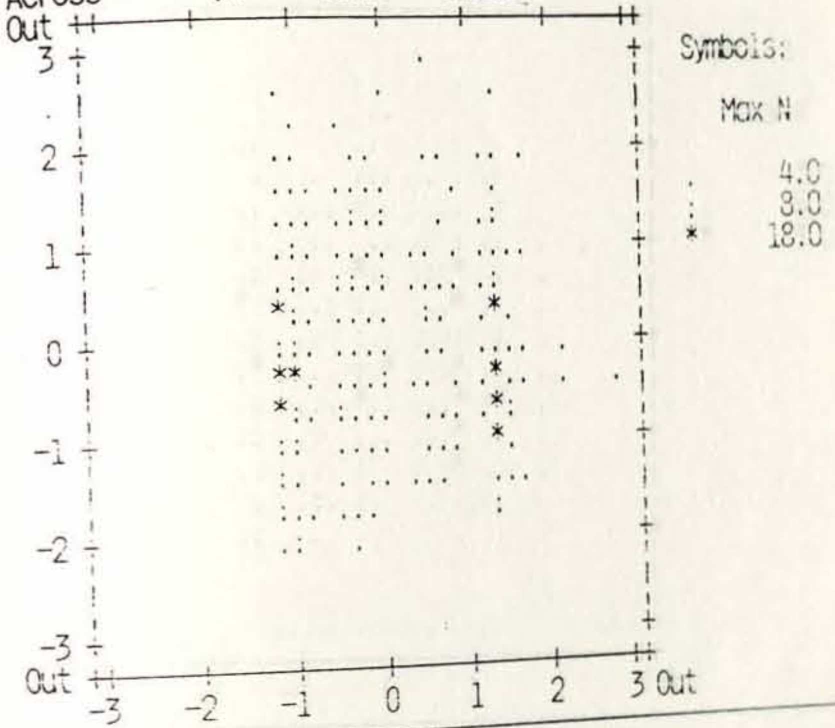

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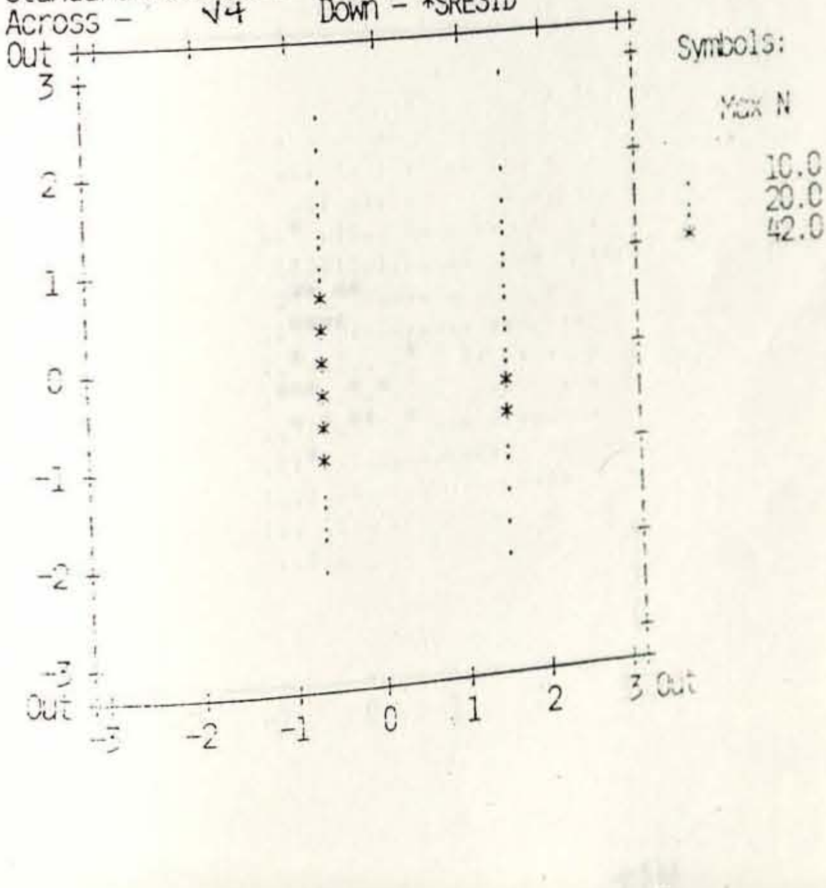
Standardized Scatterplot
Across - V4 Down - *SRESID



Page 36 SPSS/PC+

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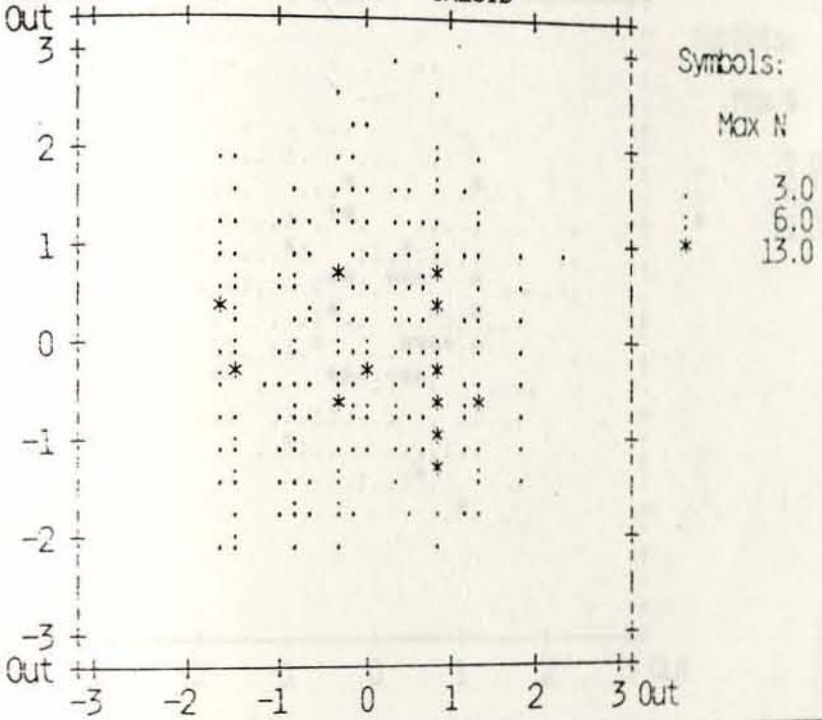
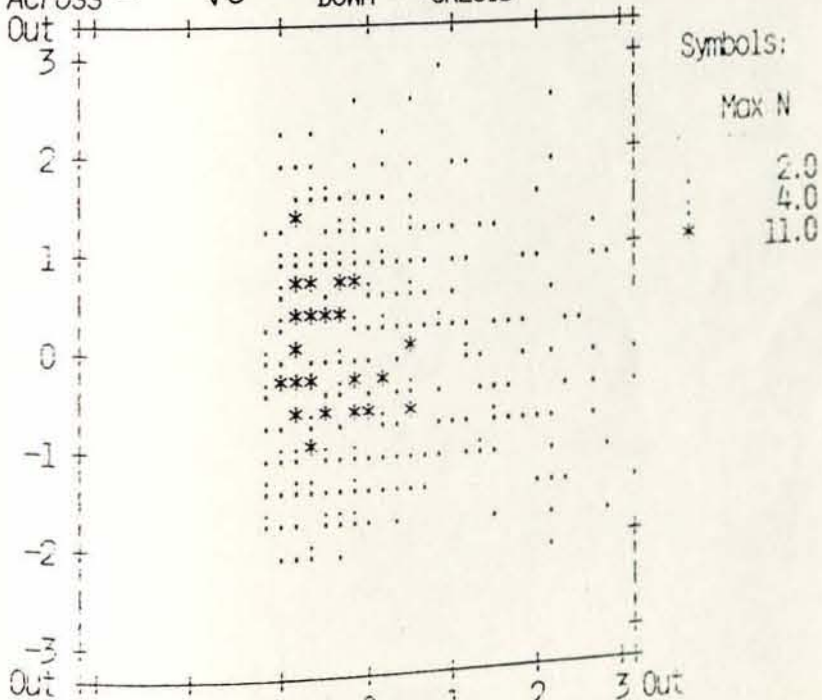
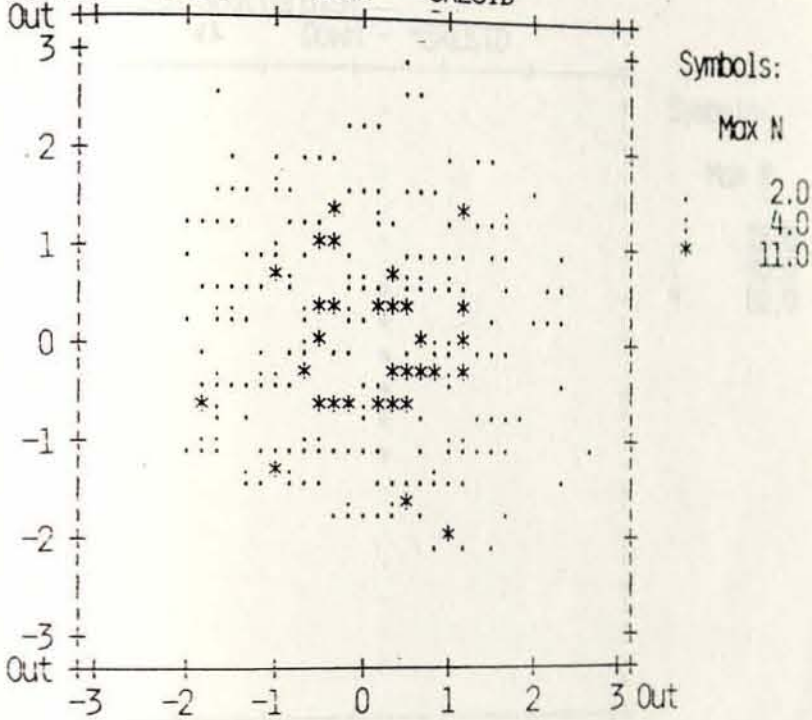


Page 37 SPSS/PC+

Standardized Scatterplot
Across - V6 Down - *SRESID



Standardized Scatterplot
Across - *PRED Down - *SRESID



APPENDIX 3 SCATTER PLOTS: A.G 35-4

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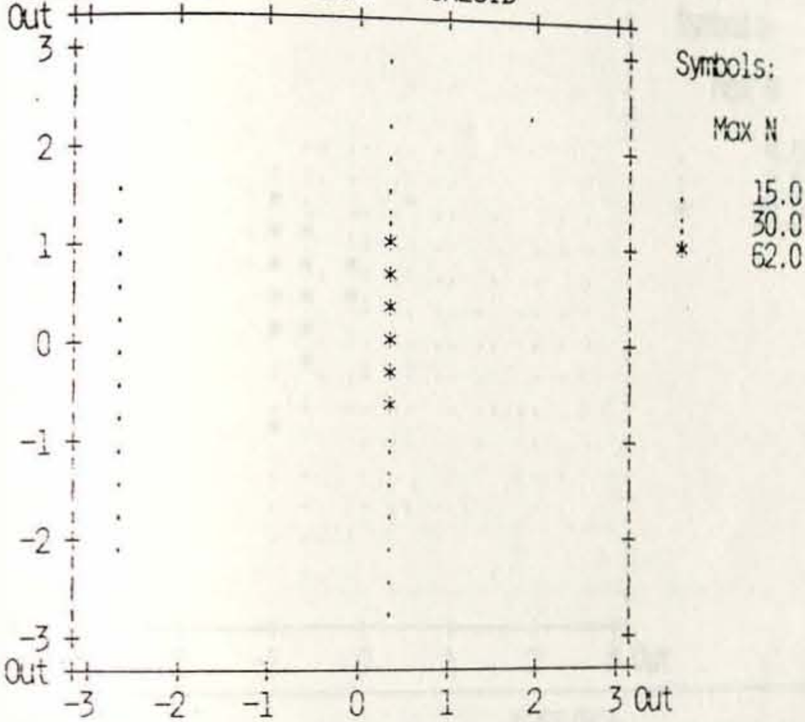
Standardized Scatterplot
Across - V1 Down - *SRESID



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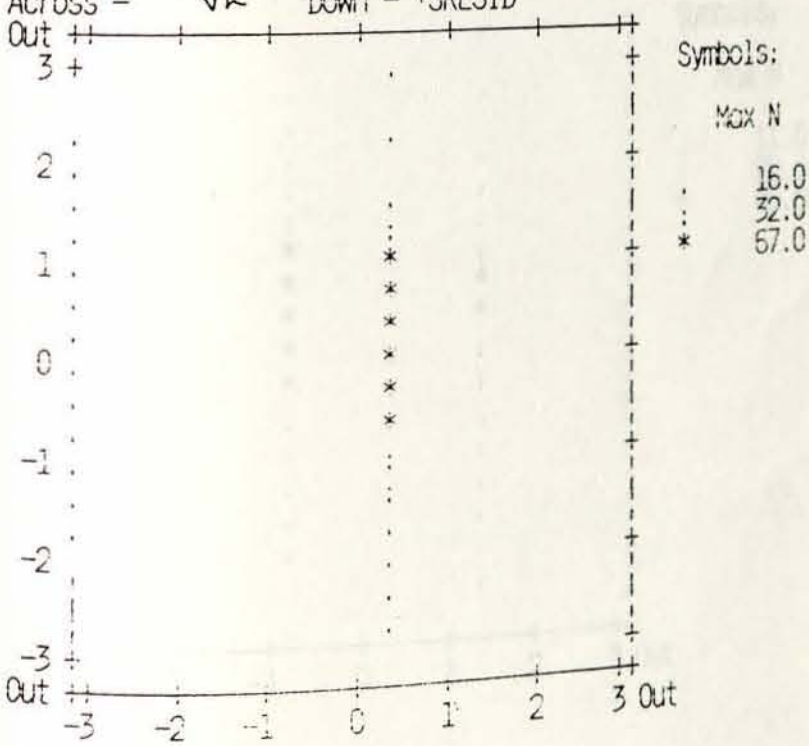
Standardized Scatterplot
Across - V2 Down - *SRESID



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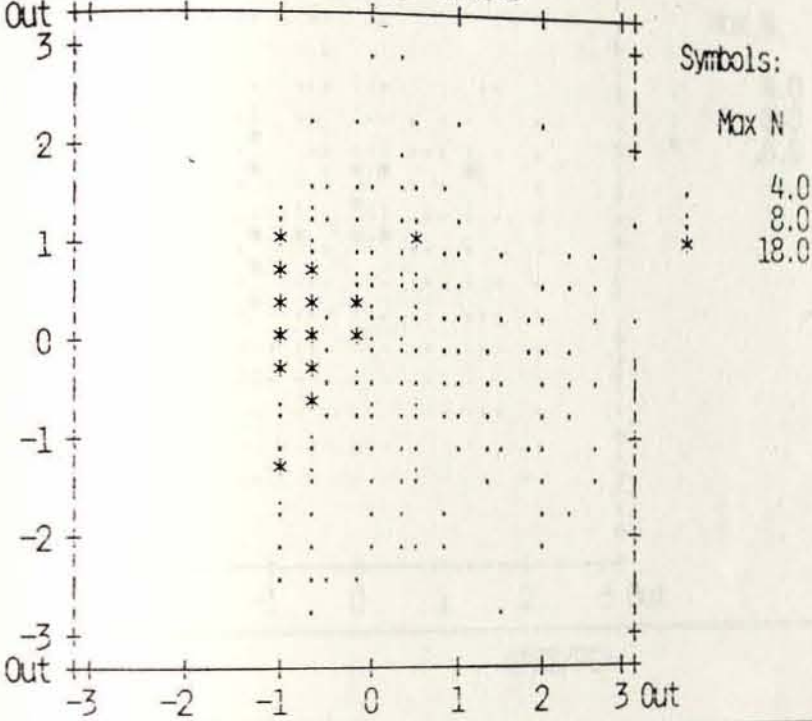
Standardized Scatterplot
Across - V3 Down - *SRESID



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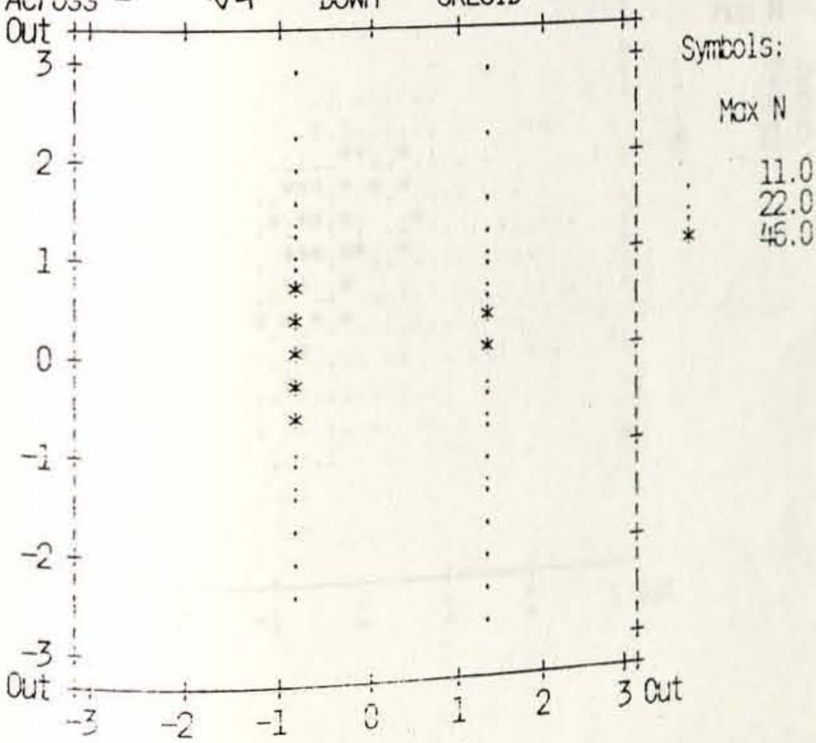
Standardized Scatterplot
Across - V4 Down - *SRESID



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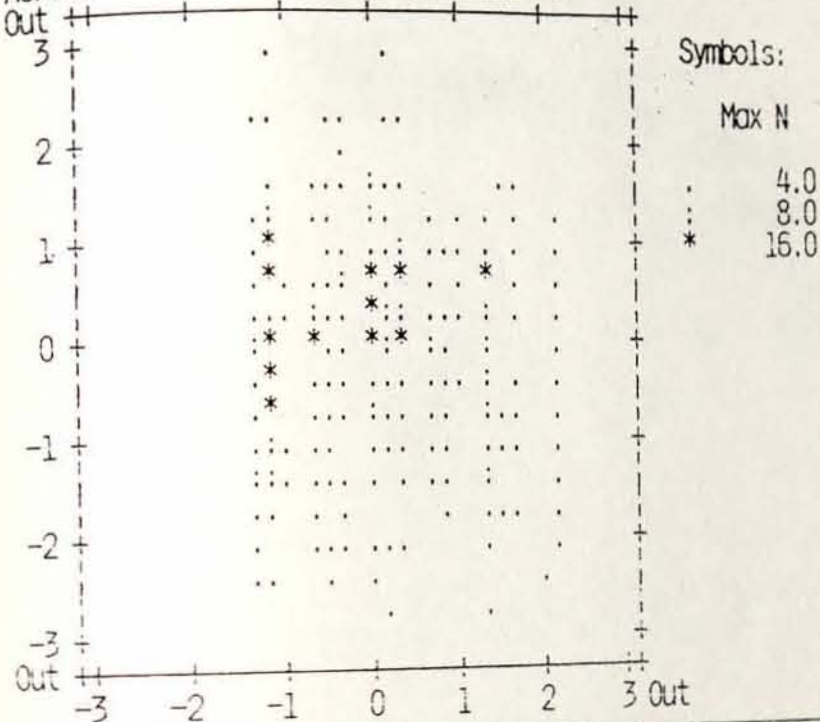
Standardized Scatterplot
Across - V5 Down - *SRESID



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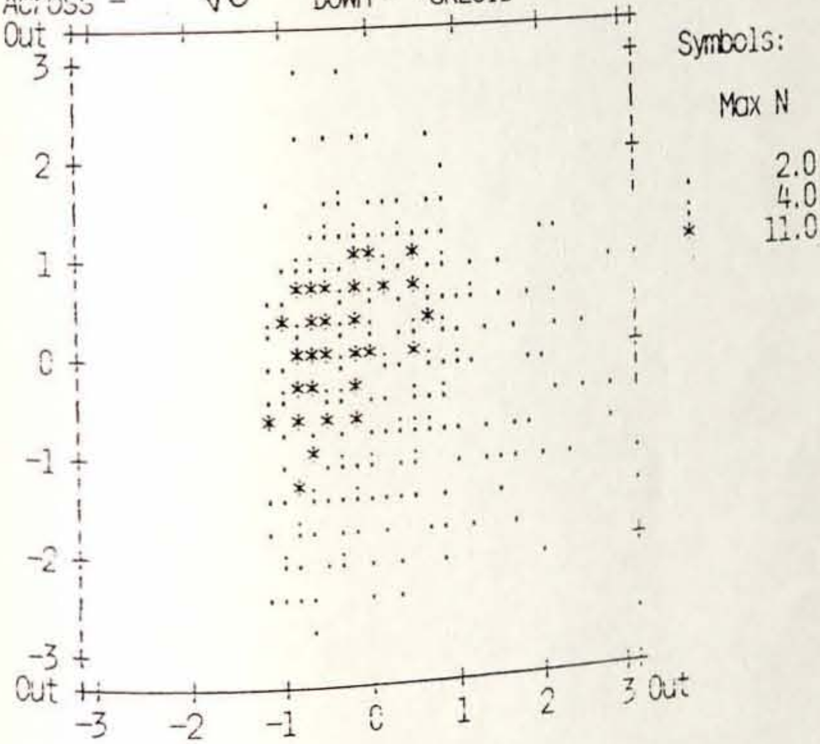
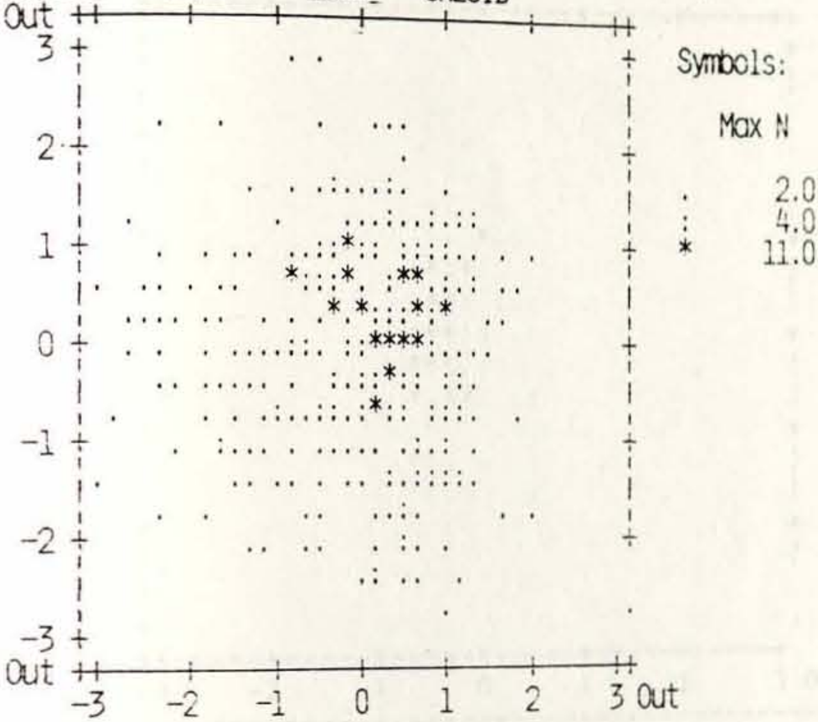
Standardized Scatterplot
Across - V6 Down - *SRESID



Standardized Scatterplot
Across - *PRED Down - *SRESID



ER PLOTS: A.G 15-24

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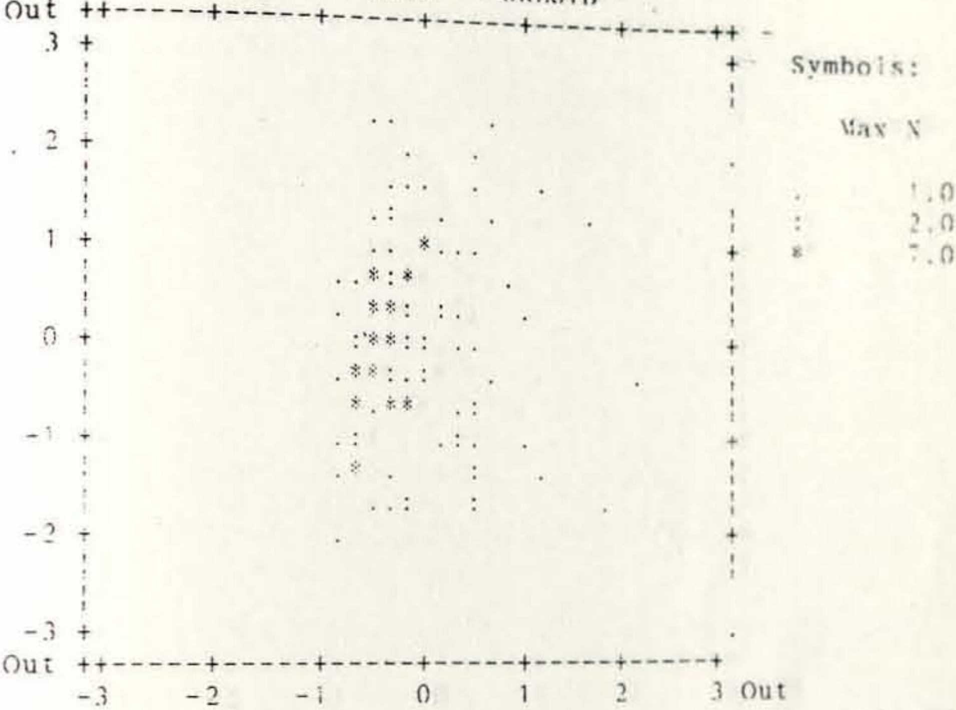
Standardized Scatterplot
Across - V5 Down - *SRESID



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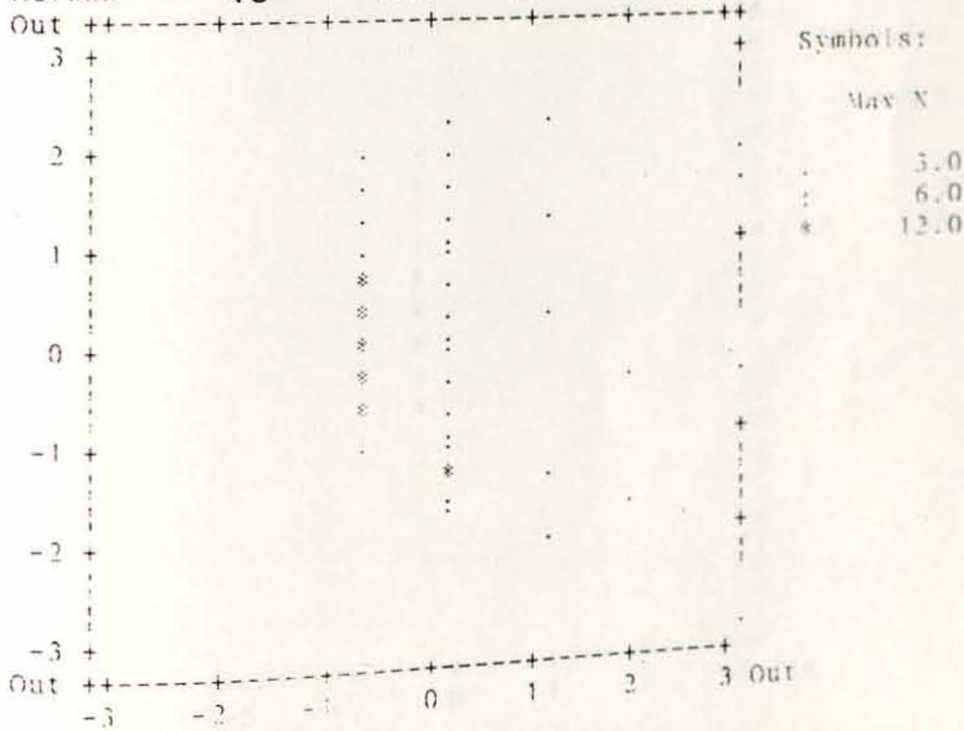
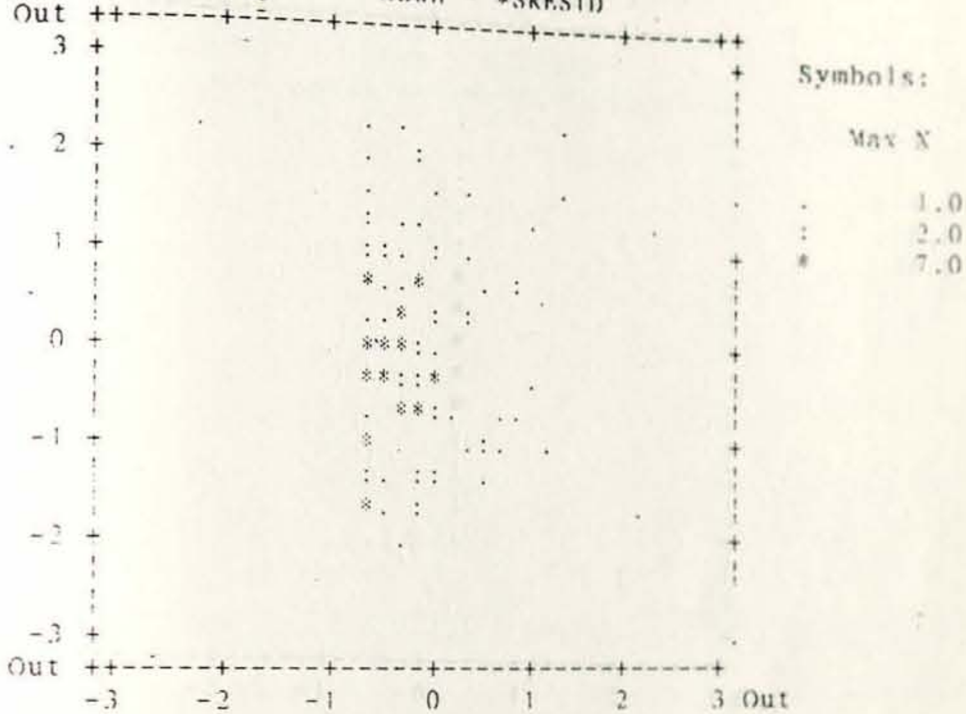
Standardized Scatterplot
Across - V6 Down - *SRESID



```
Page  42
                                        SPSS/PC+

Standardized Scatterplot
Across -     V3        Down - *SRESID
```




```
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Standardized Scatterplot
Across -     V4        Down - *SRESID
```
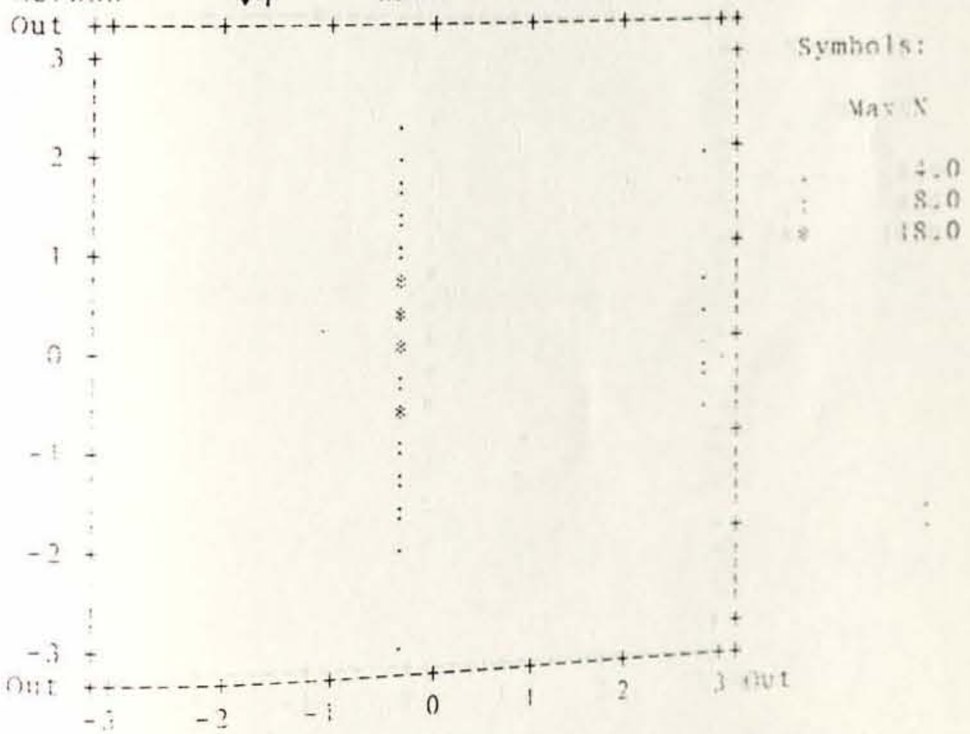
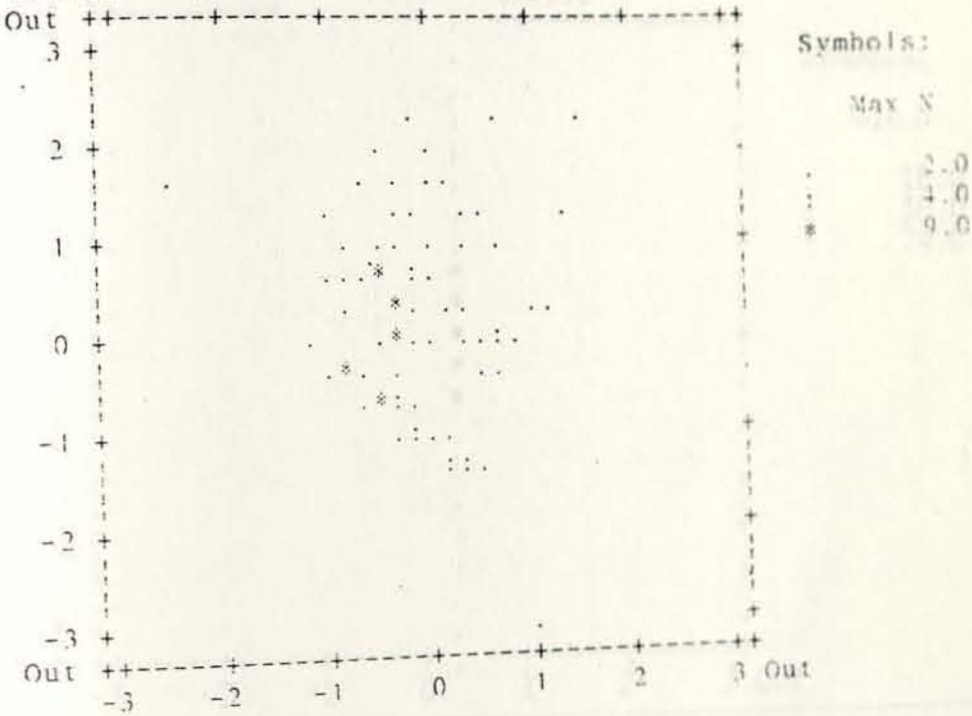



```
Standardized Scatterplot
Across -    V1          Down - *SRESID
Out ++-----+-----+-----+-----+-----+-----++
  3 +                                      +   Symbols:
    |                                      |
    |                 .                    |     Max N
  2 +                 .                    +
    |                 :                    |     .     4.0
    |                 :                    |     :     8.0
  1 +                 :                    +     *    16.0
    |                 *                    |
    |                 *                    |
  0 +                 *                    +
    |                 *                    |
    |                 *                    |
 -1 +                 :                    +
    |                 :                    |
    |                 :                    |
 -2 +                 .                    +
    |                                      |
    |                                      |
 -3 +                 .                    +
Out ++-----+-----+-----+-----+-----+-----++
   -3    -2    -1     0     1     2     3 Out
```



```
Standardized Scatterplot
Across -    V2          Down - *SRESID
Out ++-----+-----+-----+-----+-----+-----++
  3 +                                      +   Symbols:
    |                                      |
    |                 .                    |     Max N
  2 +                 .                    +
    |                 :                    |     .     4.0
    |                 :                    |     :     8.0
  1 +                 :                    +     *    16.0
    |                 *                    |
    |                 *                    |
  0 +                 *                    +
    |                 *                    |
    |                 *                    |
 -1 +                 :                    +
    |                 :                    |
    |                 :                    |
 -2 +                 .                    +
    |                                      |
    |                                      |
 -3 +                 .                    +
Out ++-----+-----+-----+-----+-----+-----++
   -3    -2    -1     0     1     2     3 Out
```

Standardized Scatterplot
Across - *PRED Down - *SRESID



APPENDIX C SCATTER PLOTS: A-G 25-34

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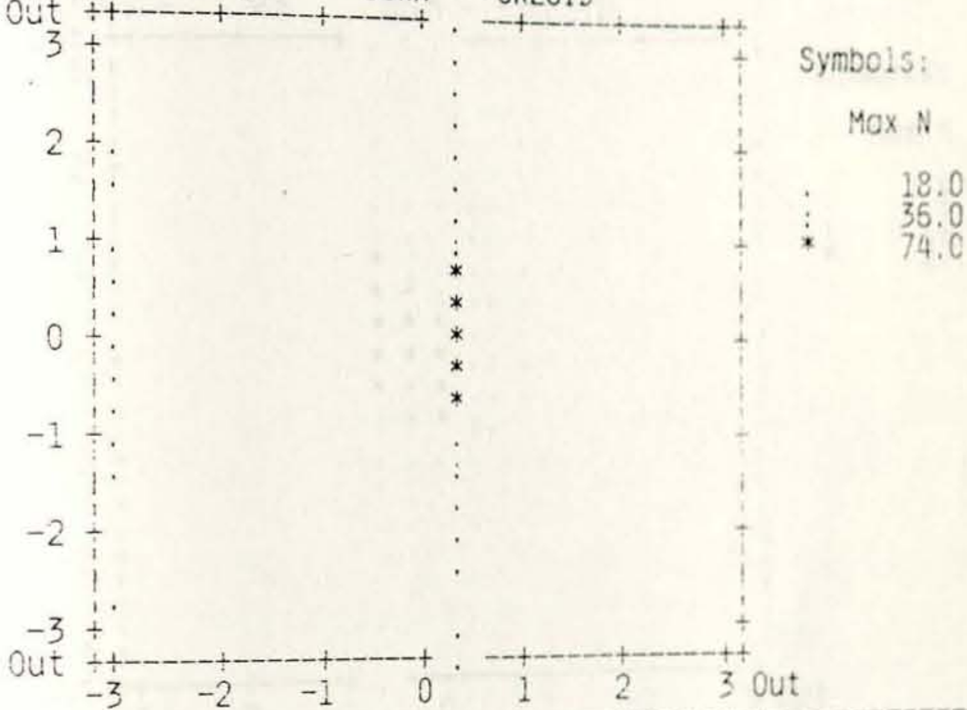
Standardized Scatterplot
Across - V1 Down - *SRESID



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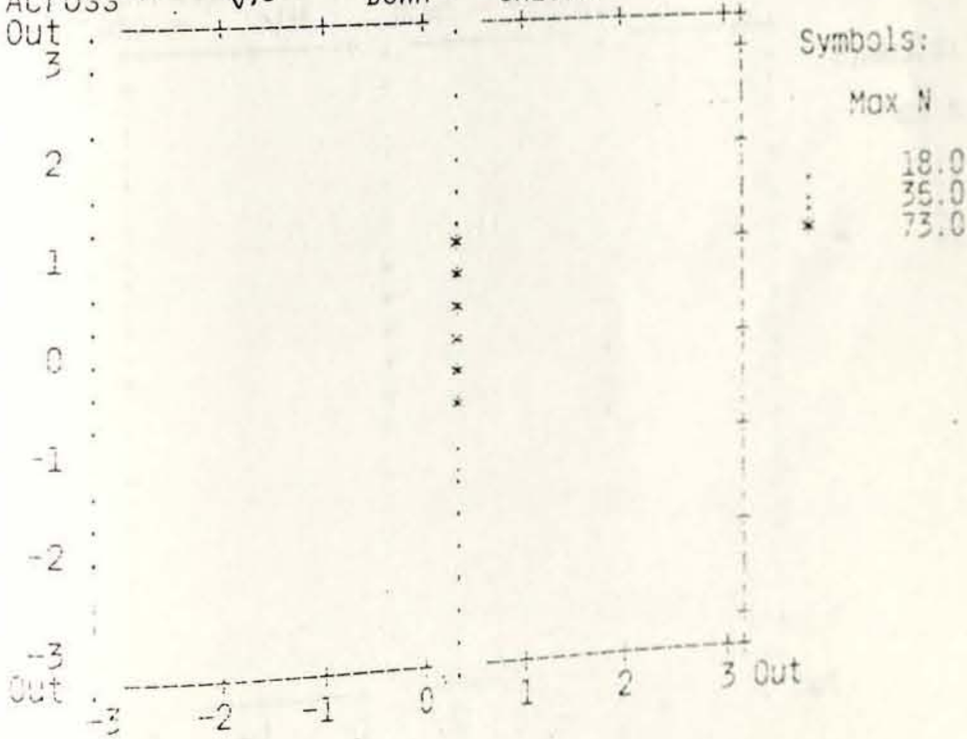
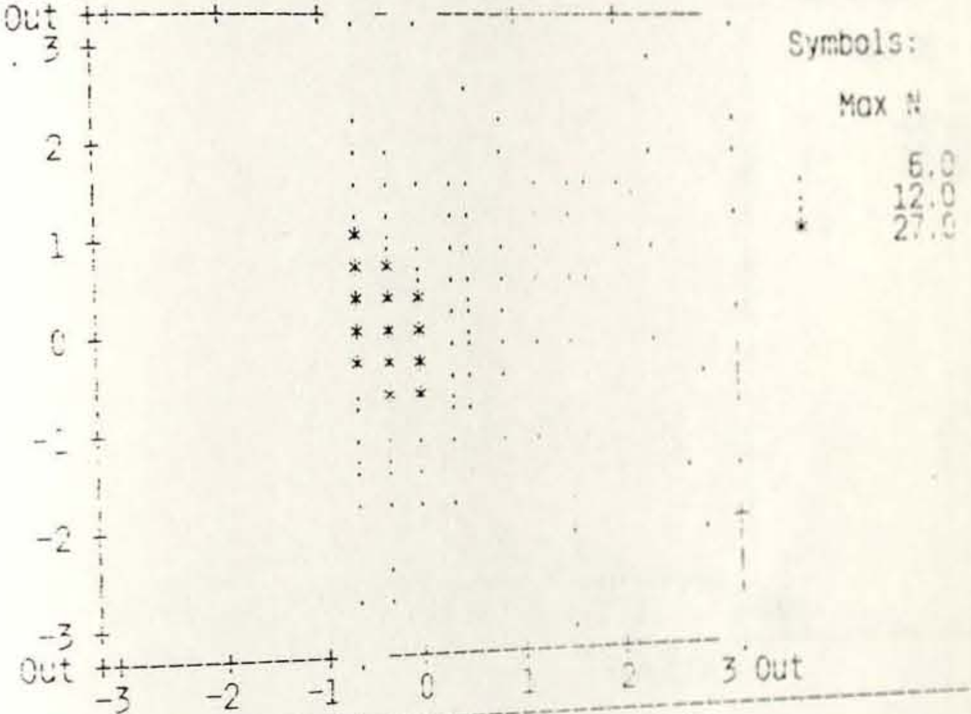
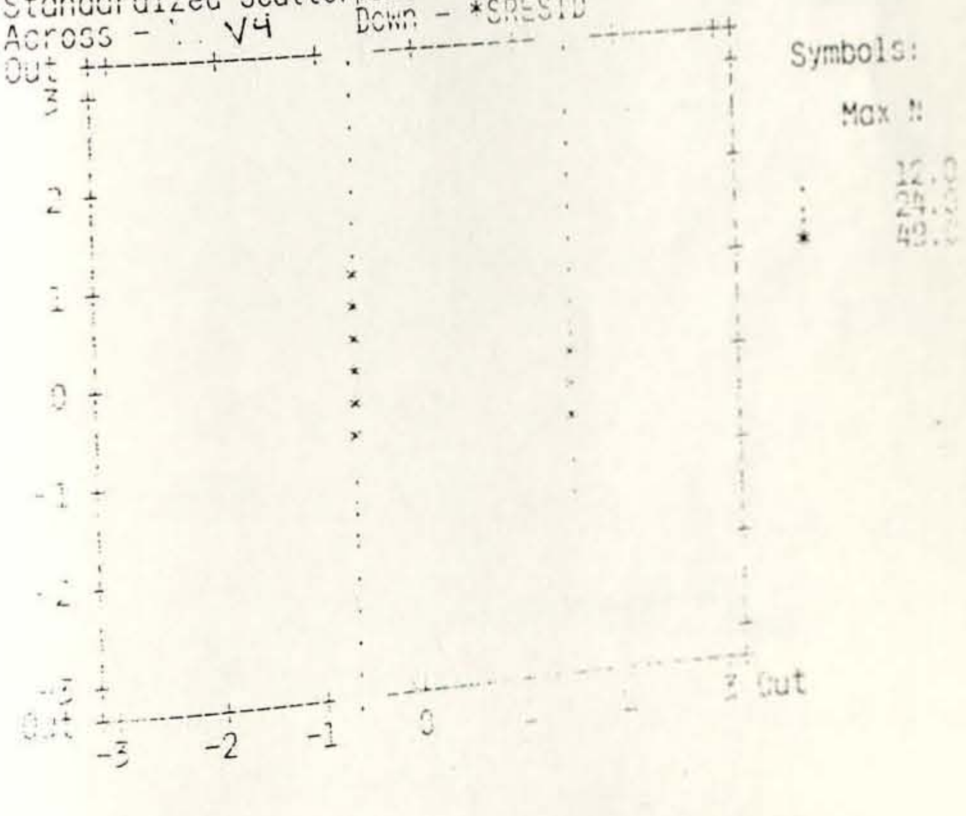
Standardized Scatterplot
Across - V2 Down - *SRESID



Standardized Scatterplot
Across - V3 Down - *SRESID



Standardized Scatterplot
Across - V4 Down - *SRESID



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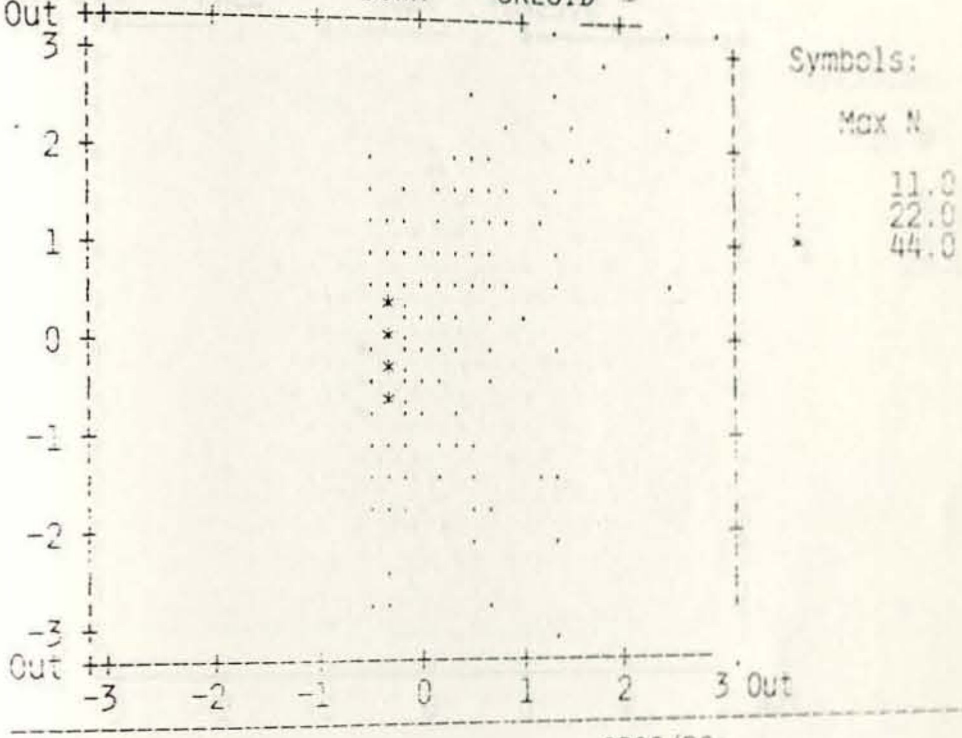
Standardized Scatterplot
Across - V5 Down - *SRESID



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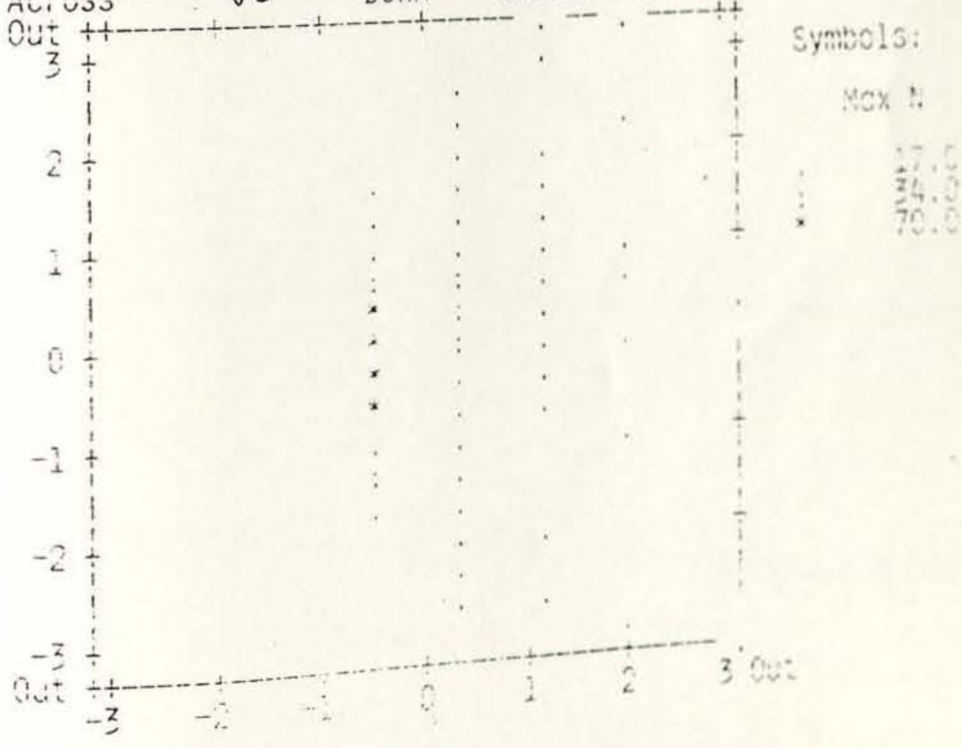
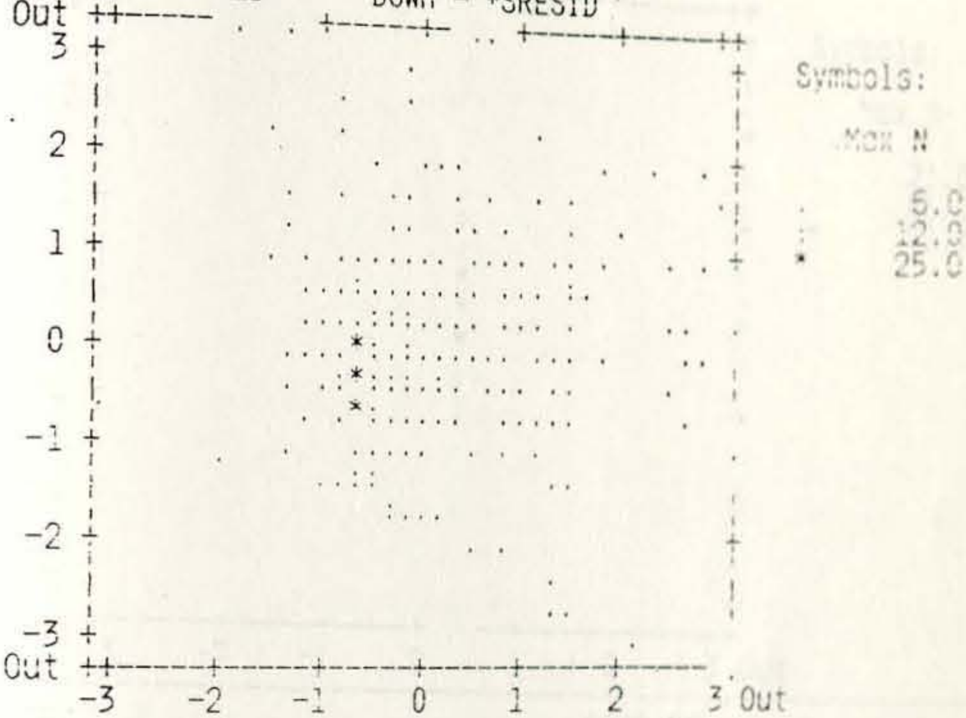
Standardized Scatterplot
Across - V6 Down - *SRESID



Standardized Scatterplot
Across - *PRED Down - *SRESID



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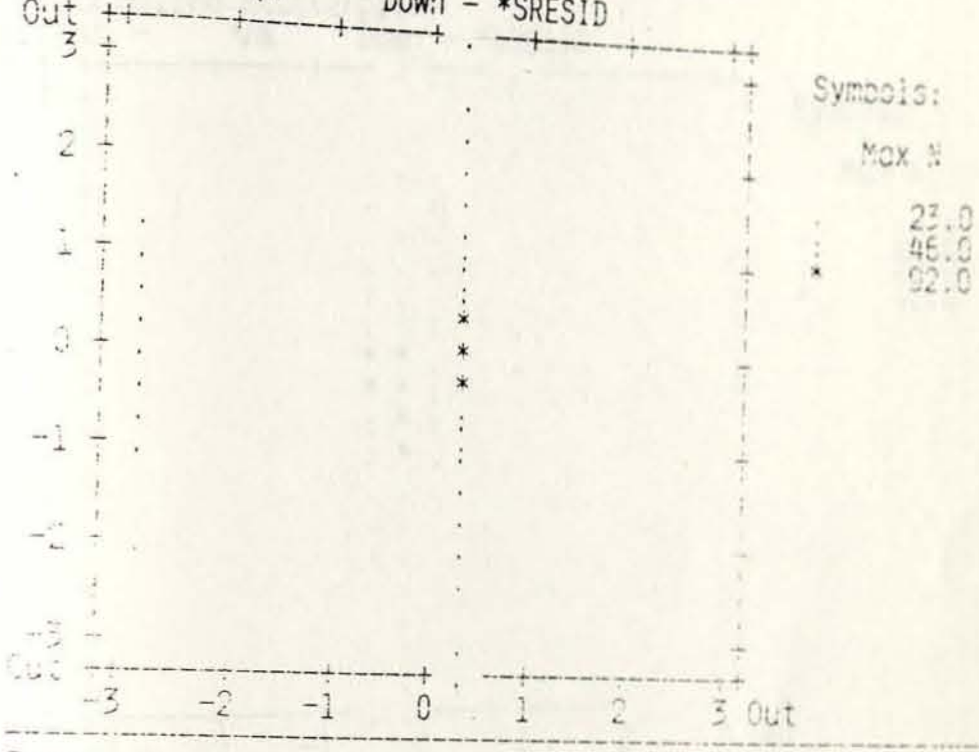
Standardized Scatterplot
Across - V1 Down - *SRESID



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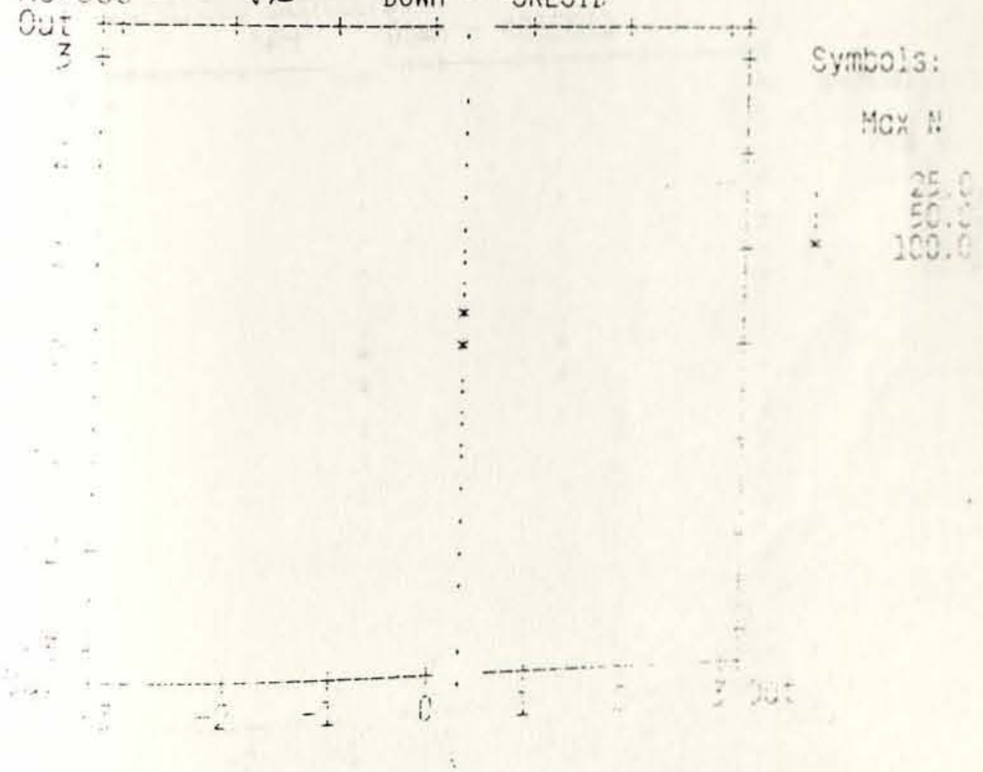
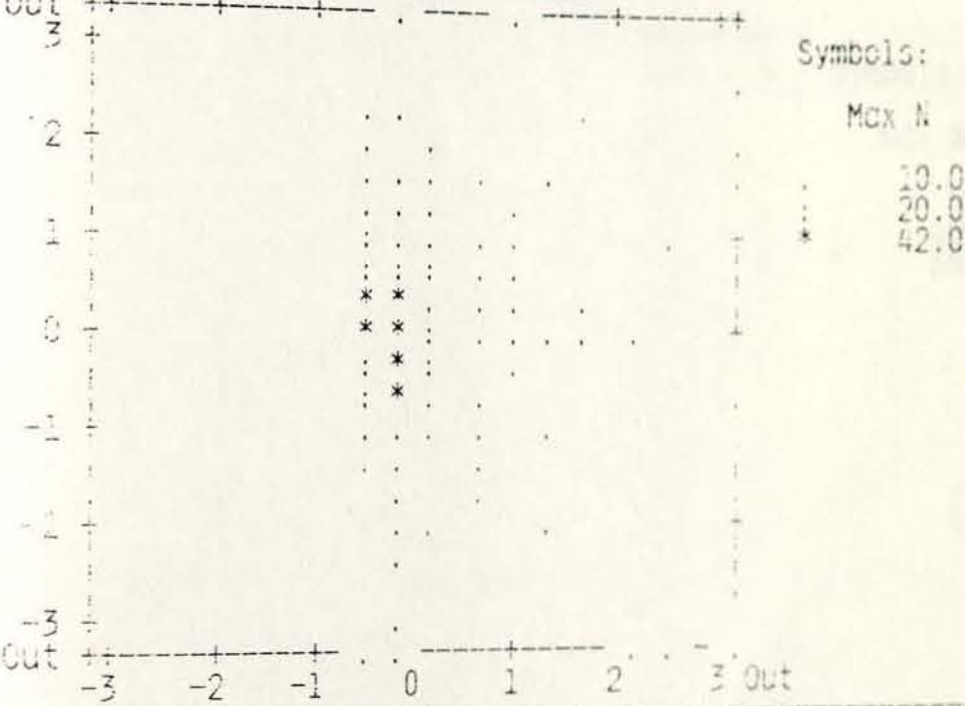
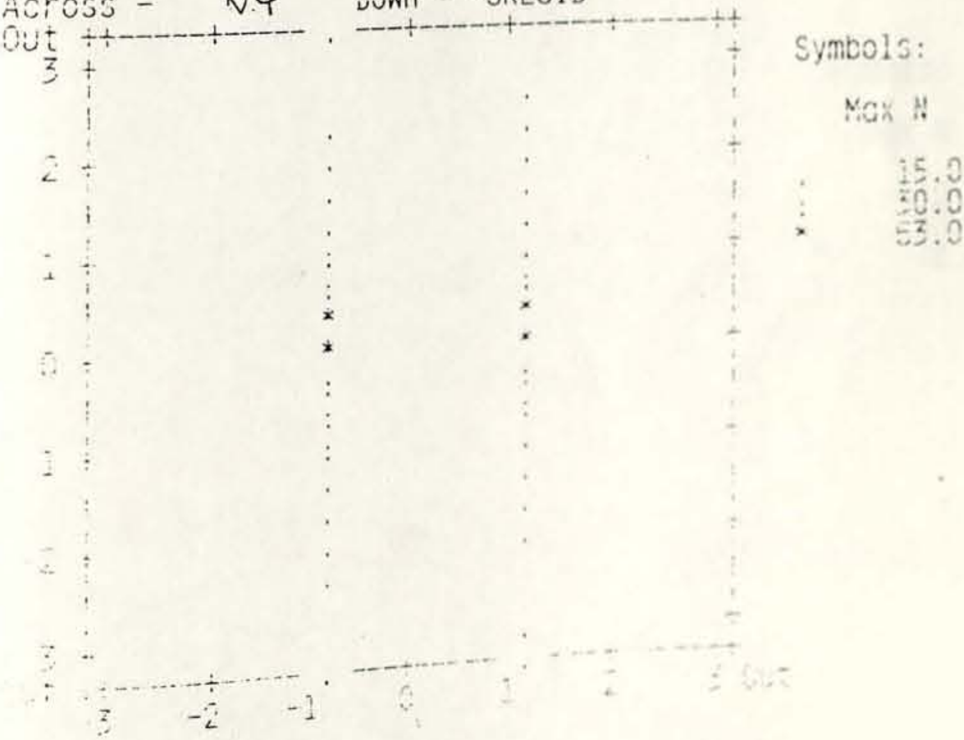
Standardized Scatterplot
Across - V2 Down - *SRESID



Standardized Scatterplot
Across - V3 Down - *SRESID



Standardized Scatterplot
Across - V4 Down - *SRESID



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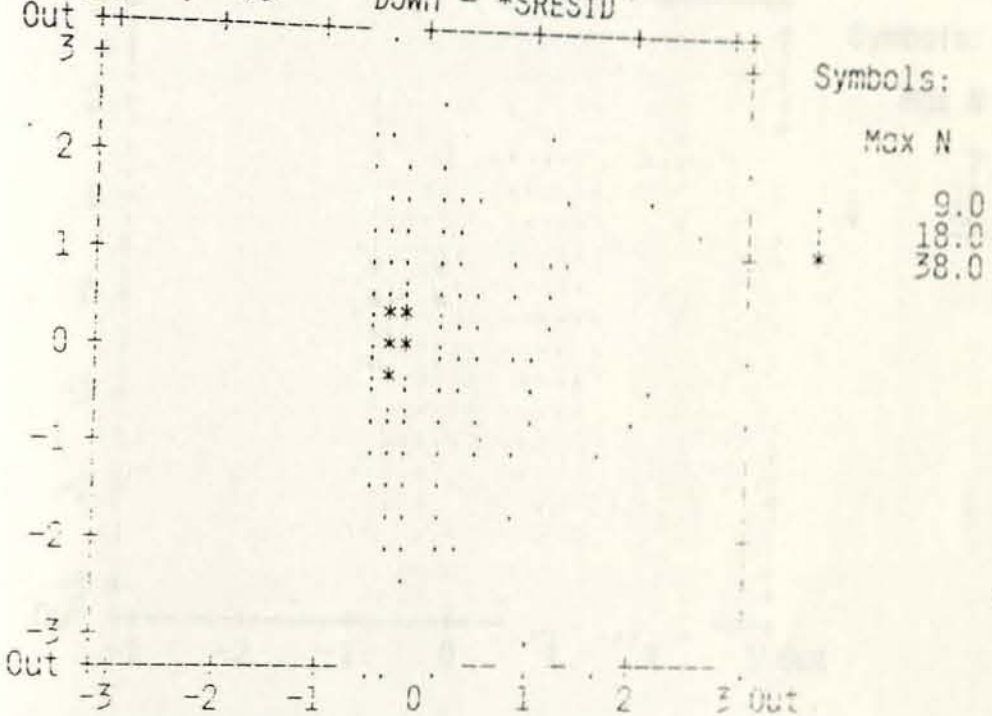
Standardized Scatterplot
Across - V5 Down - *SRESID



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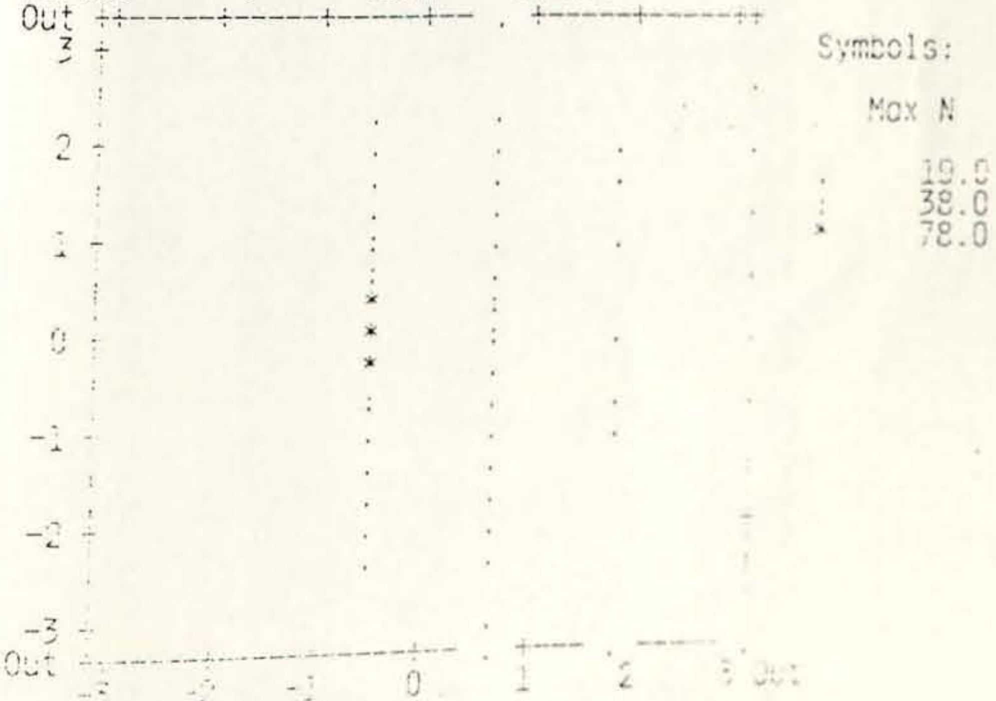
Standardized Scatterplot
Across - V6 Down - *SRESID



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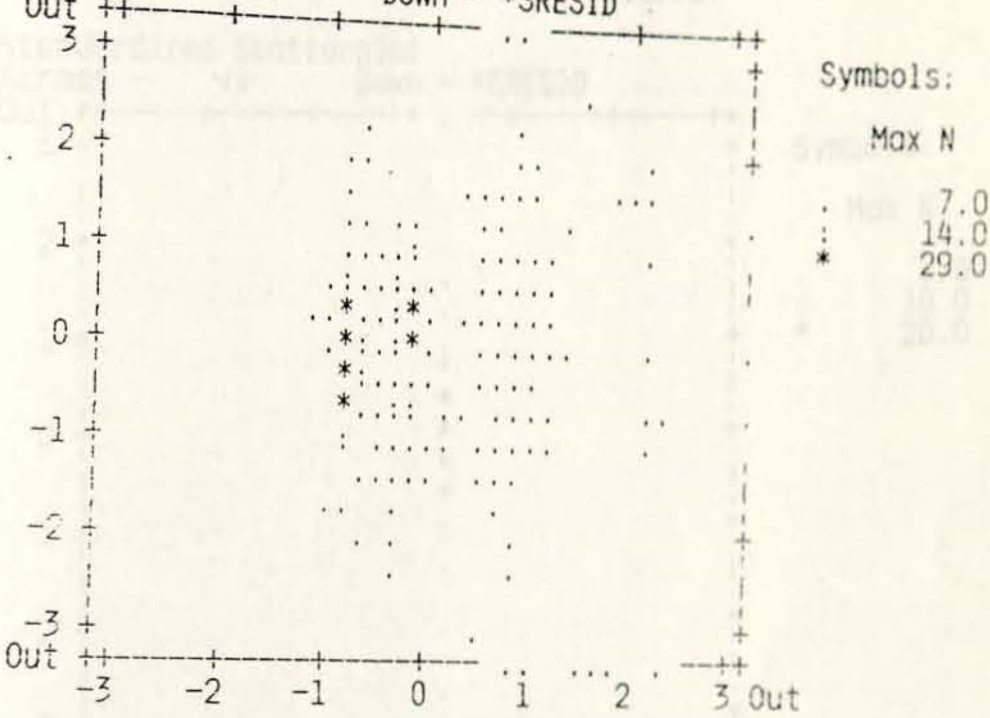
SPSS/PC+

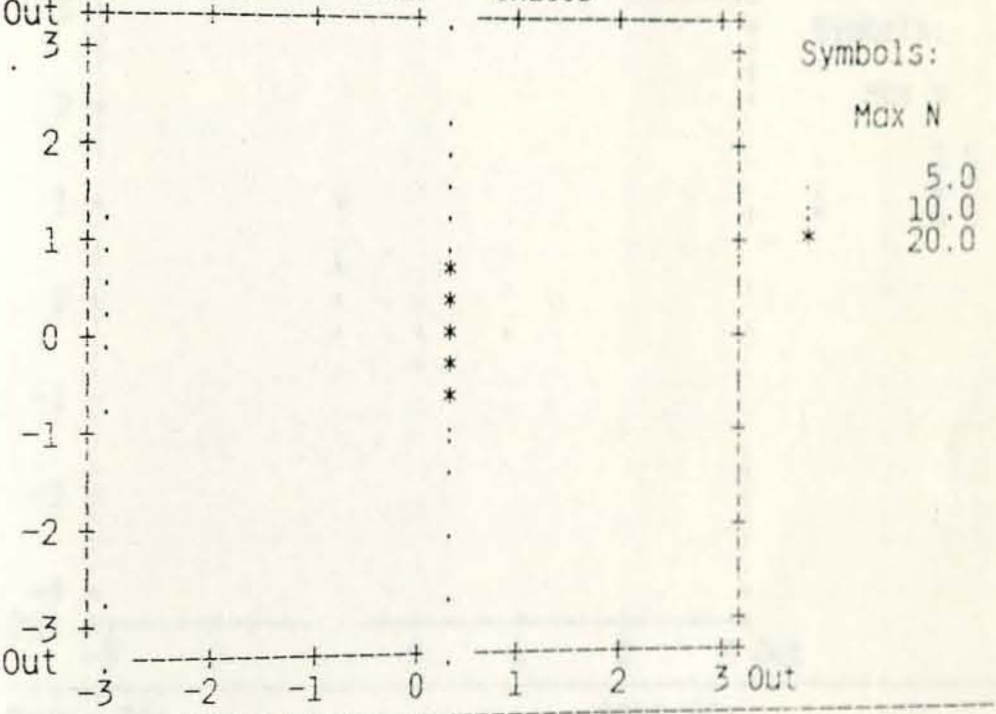
Standardized Scatterplot
Across - *PRED Down - *SRESID



APPENDIX N SCATTER PLOTS: A-G 45-49

Page 29 SPSS/PC+

Standardized Scatterplot
Across - V1 Down - *SRESID



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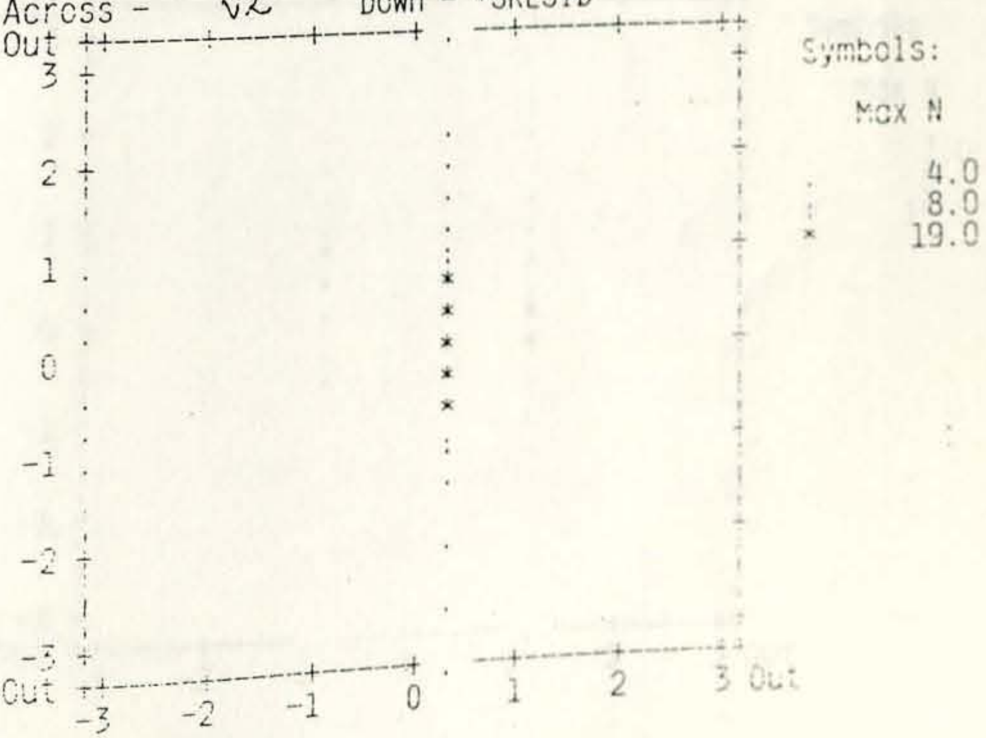
Standardized Scatterplot
Across - V2 Down - *SRESID



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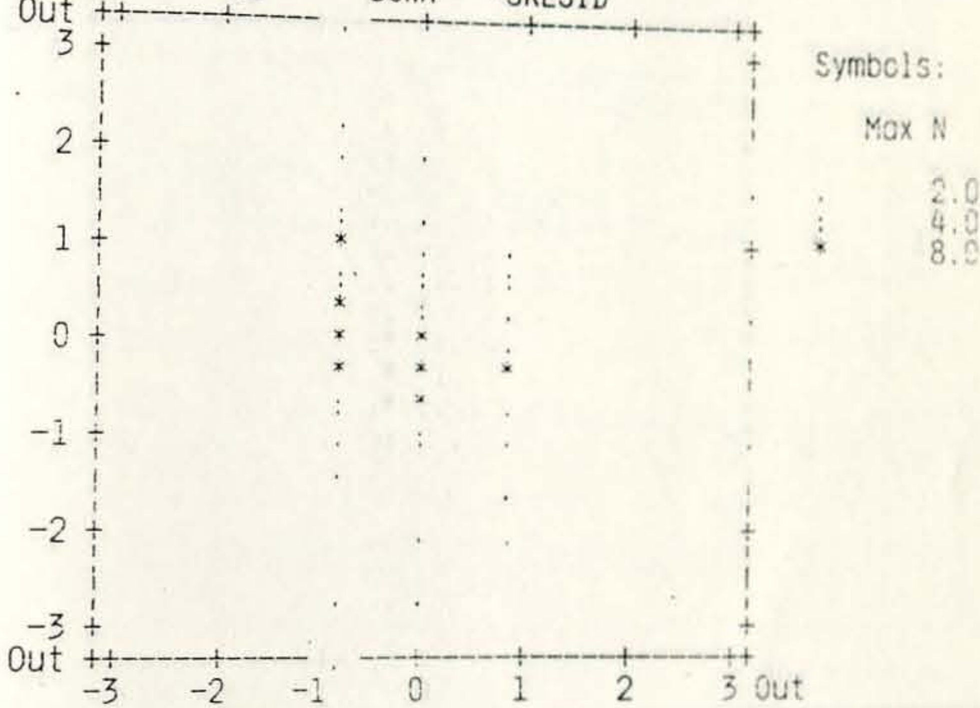
Standardized Scatterplot
Across - V3 Down - *SRESID



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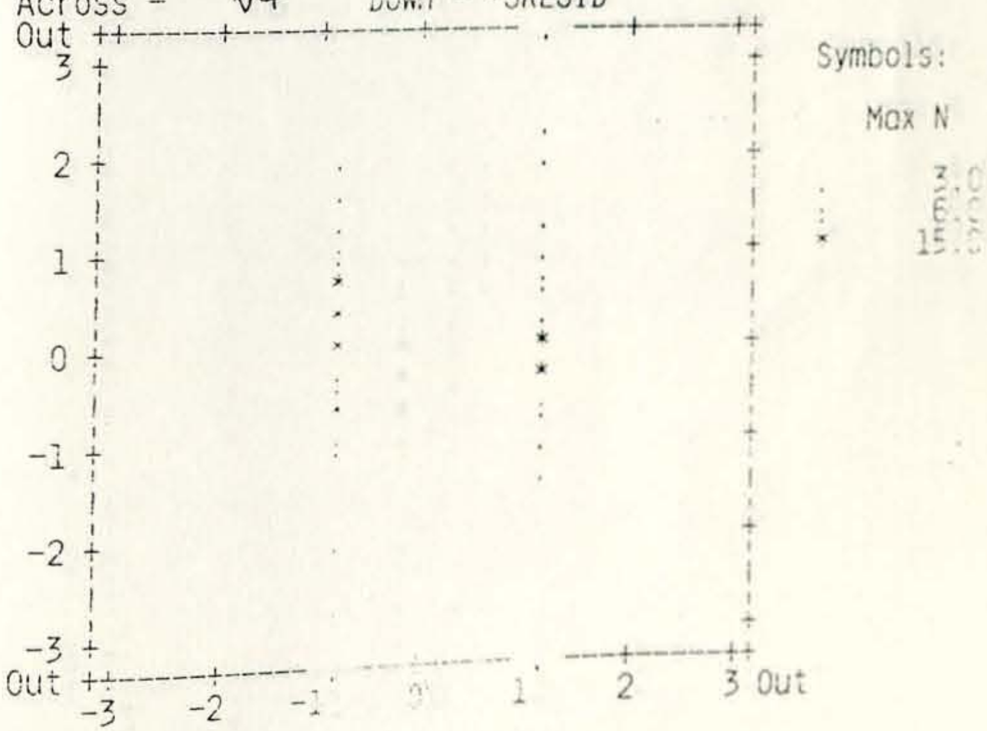
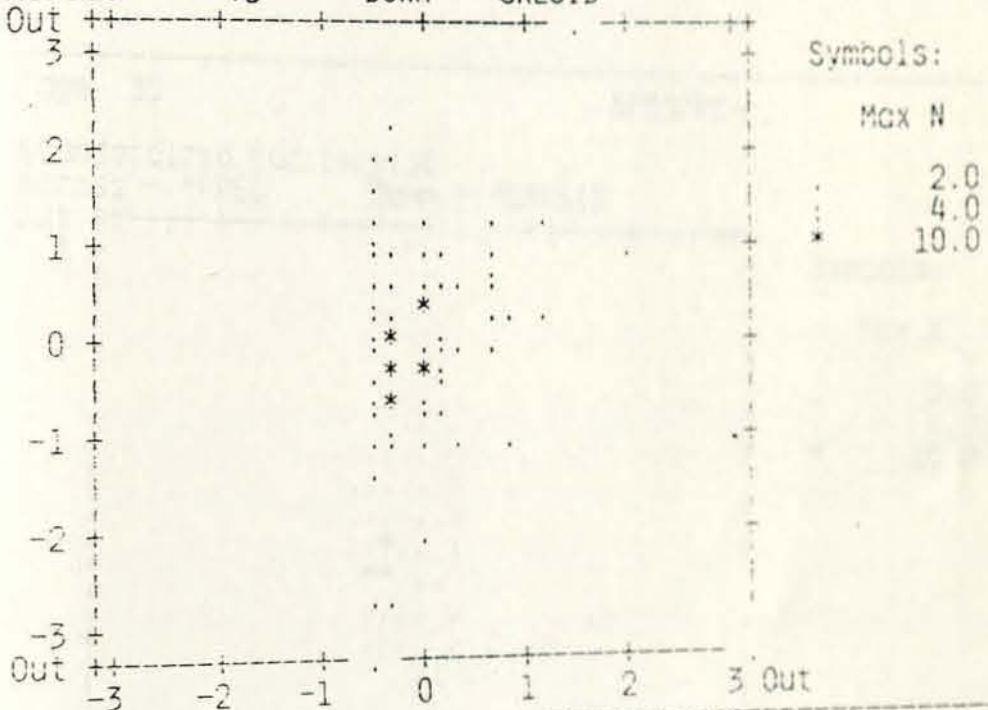
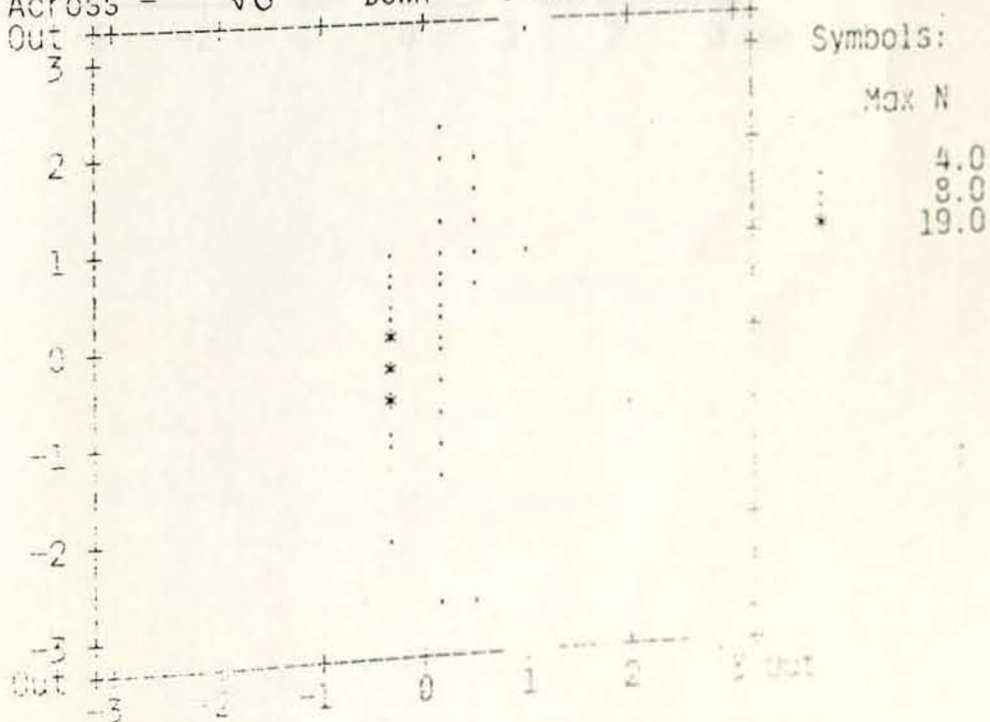
Standardized Scatterplot
Across - V4 Down - *SRESID



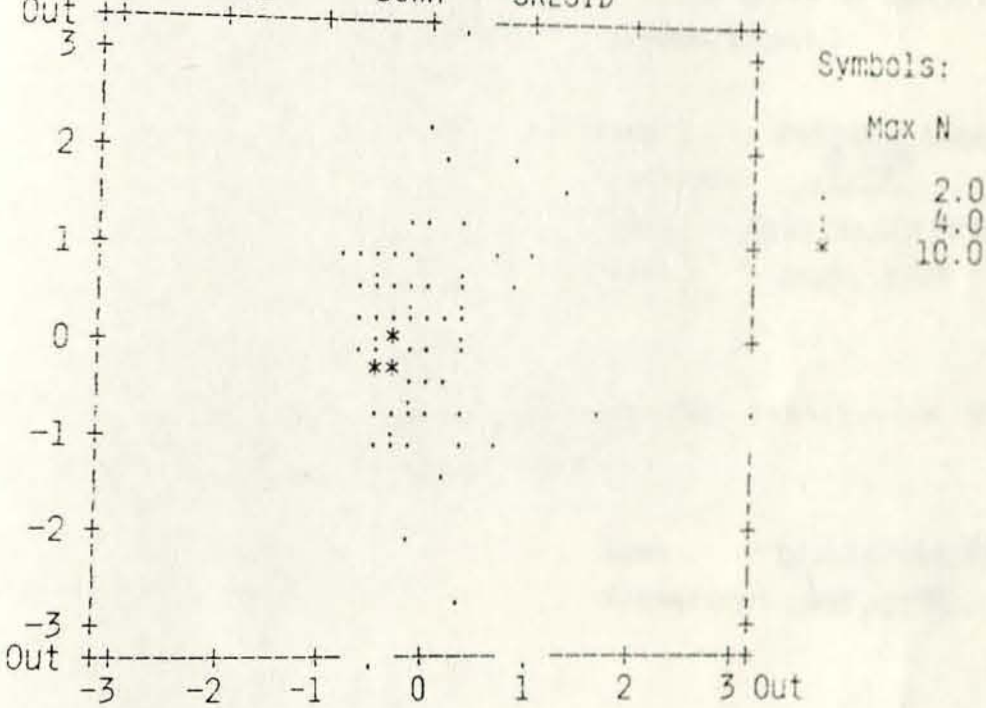
Standardized Scatterplot
Across - V5 Down - *SRESID



Standardized Scatterplot
Across - V6 Down - *SRESID



Standardized Scatterplot
Across - *PRED Down - *SRESID



DECLARATION

The thesis in my original work and has not been presented for a degree in any other University. All sources of material used for the thesis have been dully acknowledged.

Name : Habtamu Ashenafi

Signature:

Place : Statistics Department

Date : June, 1995

This thesis has been submitted for examination with my approval as a University Advisor.

Name : Dr. Eshetu Wechenko

Signature: